

MATTEO BIAGETTI

Email: OMISSIS

CURRENT POSITION

Scuola Internazionale Superiore di Studi Avanzati (SISSA)

Sep 2020– Present

Postdoctoral researcher at the Institute for Fundamental Physics of the Universe

REFEREES

Prof. Daniel Baumann

University of Amsterdam
Science Park 904
1098XH Amsterdam (NL)
email: d.d.baumann@uva.nl

Prof. Vincent Desjacques

Israel Institute of Technology
Technion
3200003 Haifa (IL)
email: dvince@physics.technion.ac.il

Prof. Antonio Riotto

University of Geneva
24 quai E. Ansermet
1211 Geneva (CH)
email: Antonio.riotto@unige.ch

Prof. Daniel Green

University of San Diego
9500 Gilman Dr.
La Jolla (US)
email: drgreen@physics.ucsd.edu

Prof. Cristiano Porciani

Argelander-Institut für Astronomie
Auf dem Hüger 71
D-53121 Bonn (D)
porciani@astro.uni-bonn.de

Dr. Emiliano Sefusatti

National Institute for Astrophysics
Via Giambattista Tiepolo, 11
34131 Trieste (I)
emiliano.sefusatti@inaf.it

EDUCATION

University of Geneva

PhD in Theoretical Physics
Advisor: Prof. Vincent Desjacques
Dissertation: *Theoretical Aspects of Large-Scale Clustering of Dark Matter Halos*

Mar 2012 – Jun 2016

University of Padova

Master's Degree in Theoretical Physics
Advisors: Profs. Nicola Bartolo and Sabino Matarrese
Dissertation: *Non-Gaussianity in multi-field models of inflation*

Sep 2009 – Dec 2011

University of Padova

Bachelor's Degree in Physics
Advisor: Prof. Andrea Vitturi
Dissertation: *Superdeformation in Atomic Nuclei*

Sep 2006 – Jul 2009

RESEARCH EXPERIENCE

University of Amsterdam

Postdoctoral Researcher
Funding: NWO VENI grant (since 2018)
Supervisor: Prof. Daniel Baumann

Oct 2016 – Aug 2020

University of Geneva

Postdoctoral Researcher
Supervisor: Prof. Vincent Desjacques

Jul 2016 – Sep 2016

GRANTS AND AWARDS

Abilitazione Scientifica Nazionale

Nov 2020

Qualified as Associate Professor in Theoretical Physics in Italy (SC FIS/02)

Valid through: 9/11/2020 – 9/11/2029

VENI grant

Aug 2018 - June 2022

Netherlands Organization for Scientific Research (NWO)

Proposal: Pushing the boundaries of the cosmological particle collider

Amount: 250 000 Euro

Computing Time at National Facility

Oct 2018 – Oct 2020

Netherlands Organization for Scientific Research (NWO)

Proposal: Cosmological Simulations of a Non-Gaussian Universe

Amount: 2 500 000 SBU¹

Travel funding

Jul 2014 and Jul 2015

Ernst et Lucie Schmidheiny foundation (CH)

Amount: 1600 Euro

RESEARCH ACTIVITY

My research focuses on the physics of the Early Universe and its imprint on the Large-Scale Structures of the Universe. With this goal in mind, I have acquired combined expertise in the study of high-energy processes relevant during inflation and in modelling physics of the late Universe.

STUDIES OF THE EARLY UNIVERSE

- Inflationary consistency relations
- Symmetries of vector perturbations during inflation
- Primordial gravitational waves
- Primordial black holes

STUDIES OF THE LATE UNIVERSE

- Large scale clustering of dark matter halos and voids
- N-body simulations
- Cosmology with massive neutrinos
- Clustering models including primordial non-Gaussianity
- Constraints on primordial features using large scale structures
- Topological data analysis applied to large scale structures

Output indicators

As of March 2022, I have 26 published papers, a citation count of 650 and a h_{hep} index of 15 on INSPIRE-HEP.

For a detailed citation record of my papers, see <http://inspirehep.net/author/profile/M.Biagetti.1>.

All my publications are in the journals with the highest impact factors in the field of Cosmology:

- 9 papers in *Journal of Cosmology and Astroparticle Physics* (JCAP) - 2019 impact factor: 5.210
- 7 papers in *Monthly Notices of the Royal Astronomical Society* (MNRAS) - 2019 impact factor: 5.356
- 6 papers in *Physical Review D* (PRD) - 2020 impact factor: 5.296
- 1 paper in *The Astrophysical Journal* (ApJ) – 2020 impact factor: 5.874
- 1 paper in *Physical Letters B* – 2020 impact factor: 4.771
- 1 review paper in *Galaxies* (MDPI) – 2020 impact factor: 1.130
- 1 paper in *Physical Review Research* (PRR)

¹ One SBU corresponds to the usage of one core of the system (24 CPU) for one hour

Computational Resources

I have acquired expertise in running and analyzing cosmological N-Body simulations and I currently own one of the largest sets of simulations with non-Gaussian initial conditions². A subset of this data has been already used in several publications.

To produce these datasets, I have successfully applied for CPU time both at University of Geneva (Baobab supercluster) and at the National Dutch Computing Facilities (Cartesius and Snellius superclusters).

INTERNATIONAL ACTIVITIES

- **Selected list of most recent invited talks**

- *Euclid Additional Probes GC telecon (zoom)*, Euclid (Jan 2022)
- *Cosmology Seminar (zoom)*, ETH (Zurich), CH (Nov 2021)
- *Cosmology Seminar (zoom)*, University of Geneva, CH (May 2021)
- *Journal Club*, University of Trento, IT (Apr 2021)
- *Cosmology Seminar (zoom)*, Lorentz Institute Leiden, NL (Nov 2020)
- *AstroCoffee (zoom)* at IAS Princeton, US (Oct 2020)
- *Special Seminar (zoom)*, IFPU Trieste, IT (Oct 2020)
- *Euclid Theory Working Group Meeting*, (zoom), (Jun 2020)
- *Cosmology Seminar*, Lorentz Institute Leiden, NL (Oct 2019)
- *Cosmology Seminar*, ICTP Trieste, IT (Oct 2019)
- *Cosmology Seminar*, Groningen, NL (Sep 2019)
- *Cosmology Lunch Seminar*, Cambridge, UK (Nov 2018)

- **Selected list of conference/workshop talks:**

- *"Latin American Workshop"*, Sao Paulo, Brazil (Dec 2020)
- *"The non-Gaussian Universe"*, Cambridge, UK (Sep 2019)
- *"String theory and Cosmology"*, Castelldefels, Spain (June 2019)
- *"Theoretical Challenges for Precision Galaxy Clustering"*, Sesto, Italy (Jul 2016)
- *"Unbiased cosmology from biased tracers"* IAS (Princeton), US (Oct 2015)
- *"Modern Cosmology: Early Universe, CMB and LSS"* Benasque, Spain (Aug 2014)
- *"Large Scale Structure"* ICTP, Trieste, Italy (Aug 2012)

- **Network of collaborators**

I have an international network of collaborators in the following institutions:

- Brookhaven National Laboratory, Upton, NY, USA
- Institute of Advanced Studies, Princeton, NY, USA
- Inter-University Centre for Astronomy & Astrophysics, Pune, India
- Ludwig-Maximilians University, Munich, Germany
- Max Planck Institute for Astrophysics, Garching, Germany
- National Technical University of Athens, Athens, Greece
- Osservatorio Astronomico di Trieste, Italy
- Perimeter Institute for Theoretical Physics, Ontario, Canada
- Scuola Internazionale Superiore di Studi Avanzati (SISSA), Italy
- Sun Yat-Sen University, Guanzhou, China
- Technion, Haifa, Israel
- Universidad Autonoma de Madrid, Spain
- University of Amsterdam, Netherlands
- University of California, San Diego, USA
- University of Geneva, Switzerland
- University of Groningen, NL
- University of Mainz, Germany
- University of Milan, IT
- University of Parma, IT
- University of Pennsylvania, USA
- University of Portsmouth, UK
- University of Trieste, IT

² Full info at <https://mbiagetti.gitlab.io/cosmos/nbody/eos/>

- University of Wisconsin-Madison, USA
- University of Zurich, CH
- Valparaíso University, Valparaíso, Chile

INTERNATIONAL MEMBERSHIPS

Member of the Euclid Collaboration

Feb 2019 – Present

Science Working Group

Working Package: “Higher-Order Statistics”

Theory Working Group

Working Package: “Initial Conditions”

MANAGEMENT AND COORDINATION

Organizer

Jul 2022

IFPU Focus Week

Title: Interpretable and Higher-Order Statistics for Late Time Cosmology

Journal Club and Seminar Organizer

Sep 2021 – Present

Institute for Fundamental Physics of the Universe

Organizer

Jul 2021

Lorentz Center Workshop

Title: Inflationary Imprints in Large Scale Structures

Website: <https://www.lorentzcenter.nl/inflationary-imprints-in-large-scale-structure-2021.html>

(Cancelled due to Covid)

Supervision of Visiting PhD students

Alex Cole (University of Wisconsin-Madison)

Nov 2019 – Dec 2019

Supervisor: Gary Shiu

Giorgio Orlando (University of Padova)

Feb 2019 – Dec 2019

Supervisor: Nicola Bartolo

Member of PhD defense committee

Sep 2019

University of Leiden

PhD candidate: Georgios Papadomanolakis

Organizer

Sep 2018 – Sep 2020

Dutch cosmology meetings

Website: <http://cosmology.nl>

Journal Club Organizer

Sep 2018 – Sep 2019

University of Amsterdam

Joint GRAPPA and Cosmology groups

PEER-REVIEWING

Referee for the journals

- Monthly Notices of the Royal Astronomical Society (MNRAS)
- Journal of Cosmology and Astroparticle Physics (JCAP)
- Astrophysical Journal (ApJ)
- Astronomy and Astrophysics (A&A)
- Physical Review D (PRD)

TEACHING ACTIVITY

Academic Teaching Assistance

Theory of fundamental interactions
Galileo Galilei Institute in Florence (IT)
International Doctoral School

Jan 2018

Mathematical Methods for Physics II
University of Geneva (CH)
Bachelor's degree in Physics

Academic years: 2015 -2016 and 2014 - 2015

Cosmology II
University of Geneva (CH)
Master's degree in Theoretical Physics

Academic year: 2013 - 2014

Mathematical Methods for Physics
University of Geneva (CH)
Bachelor's degree in Physics

Academic year: 2012 - 2013 (in French)

Tutoring program

Mathematics and Physics Courses
Gregorianum college in Padova (IT)
Bachelor's degree in Physics, Mathematics and Engineer

Academic year: 2011 -2012 (in Italian)

PUBLIC OUTREACH

Interview

National Geographic Magazine (NL)
Title: *Op zoek naar het begin der tijden*
Published in the July 2019 issue

Apr 2019

Writer

Gushmag Social Magazine
Title: *Un caffè col fisico* (in Italian)
Link: <http://www.gushmag.it/un-caffe-col-fisico/>

Nov 2013 – Jun 2016

Writer

UNOX Website
Title: *Science of Cooking*
Link: blog.unox.com/category/science-of-cooking/?lang=en

Apr 2015 – Jun 2016

Public Talk

Festival Emergency
Fonderie Kugler, Geneva (CH)
Title: *Our Universe in a lifetime*

Oct 2014

GENERAL SKILLS

Languages

Italian (native)
English (advanced)
French (intermediate)
Dutch (basic)

Programming

Fortran (intermediate)
Mathematica (intermediate)
Python (intermediate)
Supermongo (intermediate)
C (basic)

Html/CSS (basic)

Cosmological N-body simulations

2LPTic (intermediate)
Gadget (v2.0) (intermediate)
Rockstar Halo Finder (intermediate)
Amiga Halo Finder (basic)

PUBLICATION LIST

Below I list my full publication record, updated to March 2022.

A disclaimer on author ordering: my research is placed at the connection of the field of Astrophysics and Theoretical Physics. These two fields have different conventions in author ordering: the former predominantly orders author by contributions, the second by alphabetical order. Therefore, author ordering in my publication record is not uniform. All publications where I am the first author (whether alphabetical or not) I am leading or co-leading author. In publication 13) I am co-leading author.

1. **M. Biagetti**, J. Calles, L. Castiblanco, A. Cole, J. Noreña, “Fisher Forecasts for Primordial non-Gaussianity from Persistent Homology”, *arXiv: 2203.08262*
2. G. Pimentel, B. Wallisch, K. Wu, A. Achucarro, **M. Biagetti**, et al., “Inflation: Theory and Observations”, *contribution to 2022 Snowmass Summer Study*, *arXiv: 2203.08128*
3. K. Pardede, F. Rizzo, **M. Biagetti**, E. Castorina, E. Sefusatti, P. Monaco, “Bispectrum-window convolution via Hankel transform, submitted to JCAP”, *arXiv: 2203.04174*
4. **M. Biagetti**, L. Castiblanco, J. Noreña, E. Sefusatti, “The Covariance of Squeezed Bispectrum Configurations”, *submitted to JCAP*, *arXiv: 2111.05887*
5. D. Alkhanishvili, C. Porciani, E. Sefusatti, **M. Biagetti**, A. Lazanu, A. Oddo, V. Yankelevich, “The reach of next-to-leading-order perturbation theory for the matter bispectrum”, *submitted to MNRAS*, *arXiv: 2107.08054*
6. **M. Biagetti**, V. De Luca, G. Franciolini, A. Kehagias, A. Riotto, “The Formation Probability of Primordial Black Holes”, *PLB 820 (2021) 136602*, *arXiv: 2105.07810*
7. A. Cole, **M. Biagetti**, G. Shiu, “Topological Echoes of Primordial Physics in the Universe at Large Scales”, *contribution to NeurIPS 2020*, *arXiv: 2012.03616*
8. A. Moradinezhad Dizgah, **M. Biagetti**, E. Sefusatti, V. Desjacques, J. Noreña, “Primordial Non-Gaussianity from Biased Tracers: Likelihood Analysis of Real-Space Power Spectrum and Bispectrum”, *JCAP 05 (2021) 015*, *arXiv: 2010.14523*
9. **M. Biagetti**, A. Cole, G. Shiu, “The Persistence of Large Scale Structures I: Primordial non-Gaussianity”, *JCAP 04 (2021) 061*, *arXiv:2009.04819*
10. **M. Biagetti**, G. Orlando, “Primordial Gravitational Waves from Galaxy Intrinsic Alignments”, *JCAP 07 (2020) 005*, *arXiv:2001.05930*
11. K. C. Chan, Y. Li, **M. Biagetti**, N. Hamaus, “Measurement of Void Bias Using Separate Universe Simulations”, *ApJ 2, 889 (2020)*, *arXiv: 1909.03736*
12. **M. Biagetti**, “The Hunt for Primordial Interactions in the Large Scale Structures of the Universe”, *Galaxies 7, 3 (2019)*, *arXiv:1906.12244*
13. F. Beutler, **M. Biagetti**, D. Green, A. Slosar, B. Wallisch, “Primordial Features from Linear to Nonlinear Scales”, *PRR 1,3, 033209 (2019)*, *arXiv: 1906.08758*
14. K. C. Chan, N. Hamaus, **M. Biagetti**, “Constraint of Void Bias on Primordial non-Gaussianity”, *PRD D99, 121304 (2019)*, *arXiv:1812.04024*
15. **M. Biagetti**, G. Franciolini, A. Kehagias, A. Riotto, “Primordial Black Holes from Inflation and Quantum Diffusion”, *JCAP 1807, 032 (2018)*, *arXiv:1804.07124*
16. A. Nusser, **M. Biagetti**, V. Desjacques, “Abundance of peaks and dips in three-dimensional mass and halo density fields: a test for cosmology”, *MNRAS 480, 1599 (2018)*, *arXiv:1804.05328*
17. **M. Biagetti**, M. Fasiello, E. Dimastrogiovanni, “Possible Signatures of the Inflationary Particle Content: Spin-2 fields”, *JCAP 1710, 038 (2017)*, *arXiv:1708.01587*
18. **M. Biagetti**, T. Lazeyras, T. Baldauf, V. Desjacques, F. Schmidt, “Verifying the consistency relation for the scale dependent bias from local primordial non-Gaussianity”, *MNRAS 468, 3 (2017)*, *arXiv:1611.04901*
19. A. Moradinezhad, K. C. Chan, J. Noreña, **M. Biagetti**, V. Desjacques, “Squeezing the halo bispectrum: a test of bias models”, *JCAP 1609, 030 (2016)*, *arXiv:1512.06084*
20. **M. Biagetti**, A. Kehagias, D. Racco, A. Riotto, “The Halo Boltzmann Equation”, *JCAP 1604, 040 (2016)*, *arXiv:1508.07330*

21. **M. Biagetti**, A. Kehagias, A. Riotto, “What can we learn from the running of the spectral index if no tensors are detected in the cosmic microwave background anisotropy”, *PRD D91* 103527 (2015), *arXiv:1502.02289*
22. **M. Biagetti**, V. Desjacques, “Scale dependent bias from an inflationary bispectrum: the effect of a stochastic moving barrier”, *MNRAS* 451 no.4, 3643-3648 (2015), *arXiv:15012.04982*
23. **M. Biagetti**, M. Fasiello, E. Dimastrogiovanni, M. Peloso, “Gravitational Waves and Scalar Perturbations from Spectator Fields”, *JCAP* 1504, 011 (2015), *arXiv:1411.3029*
24. **M. Biagetti**, V. Desjacques, A. Kehagias, A. Riotto, “Halo Velocity Bias”, *PRD D90* 103529 (2014), *arXiv:1408.0293*
25. V. Desjacques, A. Moradinezhad, **M. Biagetti**, “Ultraviolet background fluctuations with clustered sources”, *MNRAS* 444 no.3, 2793-2807 (2014), *arXiv:1406.6379*
26. **M. Biagetti**, V. Desjacques, A. Kehagias and A. Riotto, “Nonlocal halo bias with and without massive neutrinos”, *PRD D90*, 045022 (2014), *arXiv:1405.1435*
27. **M. Biagetti**, K. C. Chan, V. Desjacques, A. Paranjape, “Measuring nonlocal Lagrangian peak bias”, *MNRAS* 441 no.2, 1457-1467 (2014), *arXiv:1310.1401*
28. **M. Biagetti**, M. Fasiello, A. Riotto, “Enhancing Inflationary Tensor Modes Through Spectator Fields”, *PRD D88* 103518 (2013), *arXiv:1305.7241*
29. **M. Biagetti**, A. Kehagias, E. Morgante, H. Perrier, A. Riotto, “Symmetries of vector perturbations during DeSitter epoch”, *JCAP* 1307, 030 (2013), *arXiv: 1304.7785*
30. **M. Biagetti**, H. Perrier, A. Riotto, V. Desjacques, “Testing the running of non-Gaussianity through the CMB mu-distorsion and the halo bias”, *PRD D87* 063521 (2013), *arXiv:1301.2771*
31. **M. Biagetti**, V. Desjacques, A. Riotto, “Testing Multi-Field Inflation with Galaxy Bias”, *MNRAS* 1774-1780 (2013), *arXiv:1208.1616*

Curriculum Vitae

Giovanni Cabass

OMISSIS

Institute for Advanced Study, Princeton

September 2020 –

Member, School of Natural Sciences

Max Planck Institute for Astrophysics, Garching

November 2017 – September 2020

Postdoctoral Researcher in Dr. Fabian Schmidt's group

University of Rome "La Sapienza"

November 2014 – October 2017

Ph.D. in Astronomy, Astrophysics and Space Science

Advisor: Prof. Alessandro Melchiorri

Thesis title: "CMB Anisotropies and Spectral Distortions: Constraining Inflation at Small Scales"

Mark: cum laude

Education

University of Trieste

M.Sc. in Physics (theoretical physics curriculum)

October 2011 – October 2014

Advisor: Prof. Paolo Creminelli

Thesis topic: Preheating and Reheating in Extranatural Inflation

Mark: 110/110 cum laude

University of Trieste

B.Sc. in Physics

October 2008 – October 2011

Advisor: Prof. Ennio Gozzi

Thesis topic: Hidden-variable theories and Quantum Mechanics

Mark: 110/110

Work experience

Referee for peer-reviewed scientific journals

Journal of Cosmology and Astroparticle Physics (JCAP)

May 2018 –

Monthly Notices of the Royal Astronomical Society (MNRAS)

May 2018 –

American Astronomical Society Journals (AAS)

February 2019 –

Physical Review D (PRD)

July 2019 –

Physics of the Dark Universe (DARK)

February 2020 –

Physical Review Letters (PRL)

February 2022 –

Reviewer for research proposals

Reviewer for proposals to ETH Zurich Research Commission
Reviewer for proposals to Swiss National Science Foundation

October 2021 –
January 2022 –

Collaborations and white papers

- “Inflation: theory and observations” review for Snowmass 2021 (<https://arxiv.org/abs/2203.08128>). I work on the “Primordial non-Gaussianity and Large-Scale Structure” part. January 2022 –
- “Effective Field Theories in Cosmology” review for Snowmass 2021 (<https://arxiv.org/abs/2203.08232>). I work on the “Effective Field Theory of Inflation” part. February 2021 –
- Aquila consortium for Bayesian Large-Scale Structure inference (<https://www.aquila-consortium.org/>). I work on Bayesian inference in the context of effective field theories. September 2019 –
- Member of the working group WP 8-6X1 “Inflationary Gravitational Waves” of the ASI-COSMOS project (<http://www.cosmosnet.it/>). March 2017 – December 2019

Supervisions

M.Sc. Thesis of Jacopo Salvalaggio (University of Trieste) January 2021 – September 2021
Co-supervisor: Dr. Stefano Ansoldi (ansoldi@fulbrightmail.org)
Thesis topic: scalar-tensor non-Gaussianities in “single-clock” inflationary models
Mark: 110 cum laude

Specific professional experience

Programming languages — Mathematica, Python, C
Lectures — MPA Postdoc/Staff Lecture Series (<https://www.mpa-garching.mpg.de/~komatsu/lectureseries/2018.html>): lectures on the Effective Field Theory of Inflation

Organizer of seminars and conferences

- Organizer of cosmology seminars at Princeton University & IAS November 2020 –
- Convener of the “Inflation and primordial physics” session of the “COSMO’21” conference (<https://caps.ncsa.illinois.edu/conferences/cosmo21/>) August 2021
- Convener of the “Primordial Universe I” session of the “Cosmology from Home 2021” conference (<https://www.cosmologyfromhome.com/>) July 2021

Selected talks and conferences

Cambridge University & DAMTP - UK
Invited talk: Constraints on Inflation from the BOSS Galaxy Survey May 2022

Amsterdam University - Netherlands
Invited talk: Constraints on Inflation from the BOSS Galaxy Survey May 2022

CERN - Geneva, Switzerland
Invited talk: Constraints on Inflation from the BOSS Galaxy Survey May 2022

KICP - Chicago, USA
Invited talk: Constraints on Single-Field Inflation from the BOSS Galaxy Survey March 2022

University of Illinois - Urbana, USA

Invited talk: Constraints on Single-Field Inflation from the BOSS Galaxy Survey

February 2022

UPenn - Philadelphia, USA

Invited talk: Cosmological Information in Forward Modeling of Biased Tracers

October 2021

Institute for Advanced Study - Princeton, USA

Invited talk: Zoology of Graviton non-Gaussianities

February 2021

"Cosmological Correlators" workshop (<https://indico.cern.ch/event/943614/overview>)

Invited talk: Graviton non-Gaussianity in the EFT of Inflation

September 2020

CERN - Geneva, Switzerland

Invited talk: The EFT likelihood for Large-Scale Structure

October 2019

PASCOS 2019 XXV International Symposium

(<https://indico.hep.manchester.ac.uk/conferenceDisplay.py?confId=5326>) - Manchester, UK

Invited talk: Probing the primordial power spectrum and non-Gaussianity with μ distortions

July 2019

"Practitioner's workshop on relativistic effects in cosmology" workshop

(<https://www.ics.uzh.ch/en/events/past/PractitionersWorkshop.html>) - Zurich, Switzerland

Invited talk: CMB spectral distortions as a robust probe of primordial non-Gaussianity

June 2019

Fifteenth Marcel Grossmann Meeting - MG15 (<http://www.icra.it/mg/mg15/>) - Rome, Italy

Invited talk: Probing the primordial power spectrum and non-Gaussianity with μ distortions

July 2018

COSMOS meeting on Astroparticle and Fundamental Physics with the CMB

(<https://agenda.infn.it/event/15622/>) - Ferrara, Italy

Invited talk: Parity violation in the Effective Field Theory of Inflation

June 2018

ASI/COSMOS Early Universe meeting (<http://www.cosmosnet.it/asicosmos-early-universe-meeting/>) -
Padova, Italy

Invited talk: CMB spectral distortions as a robust probe of primordial non-Gaussianity

February 2018

Data

PRINCETON, 19 APRILE 2022

Firma

OMISSIS

Giovanni Antonio Chirilli
Curriculum Vitae

Institute for Theoretical Physics
University of Regensburg
93040 Regensburg
Germany
E-mail: Giovanni.C. OMISSIS

Personal Information

Citizenship Italian

Date of Birth OMISSIS

Education

2009 **Ph.D.** Department of Physics, Old Dominion University, Norfolk, VA USA
& Thomas Jefferson National Accelerator Facility, Newport News, VA USA
(defended on April 9th, 2009; received on August 28th, 2009)

- **Thesis:** High Energy Amplitudes in Gauge Theories in the next-to-leading-order.
- **Advisor:** Ian Balitsky

2005 **M.Sc.** Department of Physics, Old Dominion University, Norfolk, VA USA

2003 **B.Sc.** (Laurea quadriennale), Department of Physics Università del Salento, Lecce, Italy

- **Thesis:** Deeply Virtual Compton Scattering and non Diagonal Parton Distributions.
- **Advisor:** Claudio Corianò

Other Academic Training (Scholarships Awarded)

2008 (Mar 25 - Apr 4) School on Hadronic collision at the LHC and QCD at high density, Les Houches, France.

- Talk title: *Next-to-leading Order Evolution of Color Dipole.*

2007 (1-14 July) School on QCD, Low x Physics, Saturation and Diffraction, Copanello, Calabria, Italy.

- Talk title: *NLO Evolution of Color Dipole.*

2007 (30 May - 7 June) CTEQ Summer School on QCD Analysis and Phenomenology, Madison, WI USA.

2006 (23 July - 5 August) National Nuclear Physics Summer School, Indiana University, Bloomington, IN USA.

- Talk title: *Small- x Evolution of Wilson lines.*



2005 (31 May - 17 June) Hampton University Graduate Studies Summer School, Thomas Jefferson National Accelerator Facility (JLAB), Newport News, VA USA).

- Talk title: *BFKL Equation*.

Awards and Distinctions

2015-2029 National Scientific Qualification for Associate Professor of Theoretical Physics of Fundamental Interactions, Italy *Abilitazione Nazionale Scientifica 02/A2 - II Fascia*

2009 Old Dominion University, College of Science Award: Outstanding Ph.D. Dissertation Award.

2008 Southern Universities Research Association (SURA) Graduate Research Fellowship at Thomas Jefferson National Accelerator Facility (JLAB):

https://www.odu.edu/news/news-archive/2008/06/TwoODUD_10346#.YD9UEZNKhTZ

"Each fellowship award is comprised of one-half of an academic year research assistant stipend, plus a \$2,000 supplement. The home institution matches half of the research assistantship. The award includes up to an additional \$2,000 for research related travel support for the student."

2005 Old Dominion University,

College of Science and Physics Department Award: Outstanding Score on Qualifying Exam.

https://www.odu.edu/news/news-archive/2005/04/COLLEGE OFS_8949#.YD9TBJNKhTY

Research Experience - Employment

Jan 2016 - Present Assistant Professor (Akademischen Rat auf Zeit) 3+3+1-years position at the Institute for Theoretical Physics of the University of Regensburg, Germany.

Oct 2012 - Dec 2015 Post Doctoral position at The Ohio State University, Columbus, OH - USA.

Oct 2010 - Sep 2012 Post Doctoral position at the Lawrence Berkeley National Laboratory, Berkeley, CA - USA.

Oct 2009 - Sep 2010 Post Doctoral position at the Centre de Physique Théorique at Ecole Polytechnique, Paris and at Laboratoire de Physique Théorique d'Orsay, Paris.

May 2004 - Aug 2009 Research in Theoretical Nuclear and Particle Physics as graduate student at Old Dominion University and at Thomas Jefferson National Accelerator Facility (JLAB), VA - USA.

2001 - 2003 Research in Theoretical Nuclear and Particle Physics as undergraduate student at the Università del Salento, Lecce, Italy.

Community Service

- Convener for 2018 (October 29-November 9) INT program *Probing Nucleons and Nuclei in High Energy Collisions* at the Institute for Nuclear Theory University of Washington, Seattle, WA - USA.



- Referee: Journal of High Energy Physics (JHEP); Nuclear Physics B (NPB); Nuclear Physics A (NPA); Physical Review D (PRD); Physical Review Letters (PRL); European Physical Journal A (EPJA).
- Referee for Czech Science Foundation.
- Referee for National Science Centre Poland.
- Member of the Electron-Ion Collider User Group (EICUG).

Teaching Experience

Future teaching activity

Summer/Fall 2022 High-energy Quantum Chromodynamics (10 hours for Ph.D. students of the University of Bari, University of Naples, and University of Salento, Italy)

Apr - Jul 2022 Lecturer for Introduction to Cosmology 2 (lecture and exercise for five hours per week for 14 weeks) at the University of Regensburg, Germany.

Past and current teaching activity

Oct 2021 - Feb 2022 Lecturer for Introduction to Cosmology and Lecturer for the exercise class of Quantum Chromodynamics (five hours per week for 15 weeks) at the University of Regensburg, Germany.

Apr - Jul 2021 Lecturer for High-energy Quantum Chromodynamics (five hours per week for 14 weeks) at the University of Regensburg, Germany.

Nov 2020 - Feb 2021 Lecturer for Classical Electrodynamics exercise class (five hours per week for 15 weeks) at the University of Regensburg, Germany.

Apr - Jul 2020 Lecturer for Advanced Classical Mechanics (Meccanica Razionale) exercise class (five hours per week for 14 weeks) at the University of Regensburg, Germany.

Oct 2019 - Feb 2020 Lecturer for Quantum Mechanics exercise class (five hours per week for 15 weeks) at the University of Regensburg, Germany.

Apr - Jul 2019 Lecturer for General Relativity exercise class (five hours per week for 14 weeks) at the University of Regensburg, Germany.

Oct 2018 - Feb 2019 Lecturer for Quantum Chromodynamics exercise class (five hours per week for 15 weeks) at the University of Regensburg, Germany.

Apr - Jul 2018 Lecturer for Quantum Electrodynamics exercise class (five hours per week for 14 weeks) at the University of Regensburg, Germany.

Oct 2017 - Feb 2018 Lecturer for Classical Electrodynamics exercise class (five hours per week for 15 weeks) at the University of Regensburg, Germany.

- Apr - Jul 2017 Lecturer for Advanced Classical Mechanics (Meccanica Razionale) exercise class (five hours per week for 14 weeks) at the University of Regensburg, Germany.
- Oct 2016 - Feb 2017 Lecturer for Classical Electrodynamics exercise class (five hours per week for 15 weeks) at the University of Regensburg, Germany.
- Apr - Jul 2016 Lecturer for Thermodynamics and Quantum Statistics exercise class (five hours per week for 14 weeks) at the University of Regensburg, Germany.
- 27-29 Jan 2012 Lecturer at the *pre-workshop Exploring QCD frontiers: from RICH and LHC to Electron Ion Collider summer school*. Stellenbosch Institute for Advanced Study, Stellenbosch, South Africa.
- Spring 2006 Lab instructor for *University Physics 231* course at the Physics Department of Old Dominion University, Norfolk - VA, USA.
- Spring 2005 Recitation for *University Physics 231* course at the Physics Department of Old Dominion University, Norfolk - VA, USA.
- Fall 2004 Lab instructor and recitation for *University Physics 231* course at the Physics Department of Old Dominion University, Norfolk - VA, USA.

Conferences and Workshops

- 19 - 22 April, 2022 *XIXth annual workshop on Soft-Collinear Effective Theory (SCET2022)* (University of Bern).
 - Talk title: “Pseudo and quasi gluon PDF in the BFKL approximation”
- 15 -17 December, 2021 *RBRC Workshop: Small- x Physics in the EIC Era* (Brookhaven National Laboratory).
 - Talk (invited) title: “Pseudo and quasi gluon PDF in the BFKL approximation”
- July 26 - August 27, 2021 *INT Program 21-2b Probing QCD at High Energy and Density with Jets* (Seattle - WA, USA).
 - Talk title: “Sub-eikonal corrections for high-energy scattering processes”
- 29 June - 1 July, 2021 *Saturation and Diffraction at the LHC and the EIC* (ECT* Trento, Italy).
 - Talk title: “The role of light-ray operators in high-energy QCD”
- 10 - 14 May, 2021 *QCD evolution workshop* (University of California at Los Angeles).
 - Talk title: “High-energy OPE for polarized DIS”
- 12 - 16 April, 2021 *XXVIII International Workshop on Deep-Inelastic Scattering and Related Subjects* (Stony Brook University, Stony Brook - NY, USA).
 - (18m) Talk title: “Quark and Gluon quasi-PDFs at low- x ”
- 07 - 11 December 2020 *Resummation, Evolution, Factorization 2020* (University of Edinburgh, Edinburgh, UK)
 - Talk title: “Quark and Gluon quasi-PDFs at low- x ”

- 25 - 29 November 2019 *Resummation, Evolution, Factorization 2019* (University of Pavia, Pavia, Italy)
 - Talk (invited) title: “Conformal invariance of TMD rapidity evolution”
- 16 - 20 September 2019 *LC2019 - QCD on the light cone: from hadrons to heavy ions* (Ecole Polytechnique, Palaiseau, France)
 - Talk title: “Sub-eikonal corrections and low- x helicity evolution”
 - Talk title: “Conformal invariance of TMD rapidity evolution”
- 10 -13 September 2019 *Towards accuracy at small x* (University of Edinburgh, Edinburgh, UK)
 - (1h) Talk (invited) title: “BFKL and impact factors at NLO”
 - (20m) Talk title: “Conformal invariance of TMD rapidity evolution”
- 8 - 12 April, 2019 *XXIV International Workshop on Deep-Inelastic Scattering and Related Subjects* (University of Turin, Turin, Italy).
 - Talk title: “Sub-eikonal spin corrections and g_1 structure function at low- x ”
- 25 - 28 June, 2018 *QCD@ Work - International Workshop on QCD - Theory and Experiment* (Matera, Italy).
 - Talk title: “OPE in Wilson lines with sub-eikonal spin corrections for TMDs and g_1 structure function”
- 21 - 25 May, 2018 *Probing QCD at the high energy frontier* (Trento, Italy).
 - Talk title: “High energy Operator Product Expansion with sub-eikonal spin corrections”
- 19 - 22 March, 2018 *International Conference on Physics Opportunities at an ElecTron-Ion Collider* (University of Regensburg, Regensburg, Germany).
 - Talk title: “Operator Product Expansion in Wilson lines with sub-eikonal spin corrections”
- 13 - 18 June, 2017 *Low- x Meeting Workshop* (Bisceglie, Italy).
 - Talk title: “Odderon and twist-3 light-ray Operators”
- 26 - 28 April, 2017 *Saturation: Recent Developments, New Ideas and Measurements* (Upton - NY, USA).
 - Talk title: “Rapidity factorization of high-energy scattering processes at NLO”
- 3 - 7 April, 2017 *XXIV International Workshop on Deep-Inelastic Scattering and Related Subjects* (University of Birmingham, Birmingham, UK).
 - Talk title: “Non-linear dynamics in DIS at NLO”
- 27 - 30 June, 2016 *QCD @ Work - International Workshop on QCD - Theory and Experiment* (Martina Franca, Italy).
 - Talk title: “Classical gluon production amplitude in heavy ion collisions”
- 30 May - 3 June, 2016 *QCD Evolution 2016* (Nikhef, Amsterdam, Netherlands).
 - Talk title: “Sub-gauge Conditions for the Gluon Propagator Singularities in Light-Cone Gauge”

- 07 - 11 September, 2015 *International Conference on Physics Opportunities at an ElecTron-Ion Collider (Poetic6)* (Ecole Polytechnique, Paris, France).
 - Talk title: “Classical gluon production amplitude in heavy ion collisions”
- 01 - 05 September, 2015 *Low-x meeting Workshop* (Sarmata Hotel, Sandomierz, Poland).
 - Talk title: “Classical gluon production amplitude in heavy ion collisions”
- 26 - 30 May, 2015 *QCD Evolution Workshop* (Newport News - JLAB - VA, USA).
 - Talk title: “Non-linear QCD Dynamics and Wilson Lines”
- April 27 - May 1, 2015 *XXIII International Workshop on Deep-Inelastic Scattering and Related Subject* (Dallas - TX, USA).
 - Talk title: “High-energy evolution of Wilson lines at the next-to-leading order”
- 03 - 07 December, 2014 *The 2nd International Conference on the Initial Stages in High-Energy Nuclear Collisions* (Napa - CA, USA).
 - Talk title: “The Balitsky-JIMWLK evolution equation at next-to-leading order”
- 03 - 06 September, 2014 *The LHC Forward Physics and Diffraction Working Group meeting* (Lawrence and Kansas City - KS, USA).
 - Talk title: “Non-linear QCD Dynamics and Wilson lines”
- 16 - 19 June, 2014 *QCD@Work - International Workshop on QCD - Theory and Experiment* (Bari, Italy).
 - Talk title: “Rapidity evolution of Wilson lines at the next-to-leading order: Balitsky-JIMWLK equation at NLO”
- 19 - 23 May, 2014 *Quark Matter 2014* (Darmstadt, Germany).
 - Talk title: “Rapidity evolution of Wilson lines at the next-to-leading order: Balitsky-JIMWLK equation at NLO”
- 12 - 16 May, 2014 *QCD Evolution Workshop* (Santa Fe - NM, USA).
 - Talk title: “Solution of the NLO BFKL Equation and $\gamma^*\gamma^*$ cross section at NLO”
- 10 - 14 February, 2014 *Scattering Amplitudes & the Multi-Regge Limit 2014* (Institute for Theoretical Physics, Autonomous University of Madrid, Madrid, Spain).
 - Talk title: “Solution of the NLO BFKL Equation and $\gamma^*\gamma^*$ cross section at NLO”
- 08 - 14 September, 2013 *International Conference on the Initial Stages in High-Energy Nuclear Collisions* (Illa de A Toxa, Galicia, Spain).
 - Talk title: “Solution of the NLO BFKL Equation and analytic NLO $\gamma^*\gamma^*$ cross section from High-Energy OPE in Wilson-line operators”
- 02 - 05 September, 2013 *Physics Opportunities at an ElecTron-Ion Collider workshop* (Jyvaskyla, Finland).
 - Talk title: “Solution of the NLO BFKL equation and Operator Product Expansion at high-energy”
- 06 - 10 May, 2013 *QCD evolution workshop* (Newport News - JLAB, VA, USA).

- Talk title: “Solution of the NLO BFKL equation”
- 14 - 17 May, 2012 *QCD evolution workshop* (Newport News - JLAB, VA - USA).
 - Talk title: “High-Energy QCD factorization from DIS to pA”
- 26 - 30 March, 2012 *XX International Workshop on Deep-Inelastic Scattering and Related Subjects (DIS 2012)* (University of Bonn, Germany).
 - Talk title: “Photon impact factor for BFKL pomeron at next-to-leading order”
- 30 January - 3 February, 2012 *Exploring QCD frontiers: from RICH and LHC to Electron Ion Collider*, (Stellenbosch, South Africa).
 - Talk title: “Photon impact factor for BFKL pomeron at next-to-leading order”
- 19 September - 18 November, 2011 *Frontiers in QCD* (Institute of Nuclear Theory, Seattle - WA, USA).
 - Talk title: “High-energy Amplitudes and Impact Factors at next-to-leading-order”
- 03 - 07 June, 2011 *Low-x Meeting Workshop*, (Santiago de Compostela, Spain).
 - Talk title: NLO Photon Impact Factor for DIS at small-x.
- 30 May - 2 June, 2011 *Standard and Novel QCD Phenomena at Hadron Colliders*, (European Centre for Theoretical Studies in Nuclear Physics and Related Areas, Trento, Italy).
 - Talk title: Non linear dynamics of the structure of hadronic matter at high-energy.
- 23 - 28 May, 2011 *22nd International Conference on Ultra-Relativistic Nucleus-Nucleus (Quark Matter 2011)*, (Annecy, France).
 - Talk title: Next-to-leading order structure function for DIS off a large nucleus.
- 11 - 15 April, 2011 *XIX International Workshop on Deep-Inelastic Scattering and Related Subjects (DIS 2011)*, (Newport News - VA, USA).
 - Talk title: NLO structure functions at small-x.
- 08 - 09 April, 2011 *QCD Evolution Workshop: from collinear to non collinear case*, (Newport News - VA, USA).
 - Talk title: NLO evolution of structure functions at small-x.
- 13 September - 19 November, 2010 *Gluons and the quarks sea at the high energies: distributions, polarizations, tomography* (Institute of Nuclear Theory, Seattle - WA, USA).
 - Talk title: “DIS in the high-energy limit at next-to-leading order”
- 10 - 15 September, 2010 *DIFFRACTION 2010 International Workshop on Diffraction in High-Energy Physics*, (Otranto, Italy).
 - Talk title: The Photon Impact Factor for DIS at NLO: analytic result.
- 22 - 28 July, 2010 *35th International Conference on High Energy Physics*, (Paris, France).
 - Poster title: The Photon Impact Factor for DIS at NLO: analytic result.

- 05 - 09 July, 2010 *Hadron Structure and QCD: from LOW to HIGH energies*, (Gatchina, St. Petersburg, Russia).
 - Talk title: The Photon Impact Factor for DIS at NLO: analytic result.
- 23 - 27 June, 2010 *Low-x Meeting Workshop*, (Kavala, Greece).
 - Talk title: Next-to-leading order Photon Impact Factor in Deep Inelastic Scattering at small- x .
- 26 - 29 May, 2010 *Convegno Nazionale di Fisica Teorica*, (Cortona, Italy).
 - Talk title: High-energy evolution of scattering amplitudes in gauge theories.
- 19 - 23 April, 2010 *XVIII International Workshop on Deep-Inelastic Scattering and Related Subjects*, (Florence, Italy).
 - Talk title: High-Energy Amplitudes and Impact Factors at next-to-leading order.
- 08 - 13 September, 2009 *Low-x Meeting Workshop*, (Ischia Island, Italy).
 - Talk title: High-Energy Operator Product Expansion at NLO.
- 20 - 25 July, 2009 *Recent Advances in Perturbative QCD and Hadronic Physics*, (Trento, Italy).
 - Talk title: Small- x Evolution in the Next-to-Leading Order.
- 26 - 31 May, 2009 *Tenth Conference on the Intersections of Particle and Nuclear Physics (CIPANP 2009)*, (San Diego - CA, USA).
 - Talk title: Small- x Evolution of Structure Functions in the next-to-leading Order.
- 11 - 16 May, 2009 *Photon09*, (Hamburg, Germany).
 - Talk title: Small- x Evolution of Structure Functions in the next-to-leading Order.
- 08 - 14 Sep, 2008 *International Workshop on Diffraction in High-Energy Physics (Diffraction 2008)*, (La Londe-les-Maures, France).
 - Talk title: NLO Evolution of Color Dipole in QCD and $\mathcal{N} = 4$ SYM.
- 14 - 18 Jul, 2008 *Structure of Hadrons and Nuclei at an Electron Ion Collider* (Trento, Italy).
 - Talk title: NLO evolution of Color Dipole in QCD and $\mathcal{N} = 4$ SYM.
- 06 - 10 Jul, 2008 *Low-x meeting workshop* (Kolimpari, Crete, Greece).
 - Talk title: Next-to-leading Order Evolution of Color Dipole.
- 19 - 23 May, 2008 *4th Electron-Ion Collider Workshop* (Hampton University, Hampton - VA, USA).
 - Talk title: Next-to-leading Order Evolution of Color Dipole.

Invited Seminars

- February 4, 2022 *Brookhaven National Laboratory* (Upton - NY, USA).

- Talk title: Pseudo and quasi PDF in the BFKL approximation.
- September 24, 2021 *Universidade Federal de Santa Catarina* (Florianópolis - Brazil).
 - Talk title: High-energy QCD dynamics with sub-eikonal corrections.
- April 9, 2021 *Brookhaven National Laboratory* (Upton - NY, USA).
 - Talk title: High-energy Operator Product Expansion at sub-eikonal level.
- December 07, 2020 *The Ohio State University* (Columbus - OH, USA).
 - Talk title: Quark and Gluon quasi-PDFs at low-x.
- March 08, 2016 *Institute of Nuclear Physics* (Krakow, Poland).
 - Talk title: Factorization for Inclusive Hadron Production in proton-Nucleus collisions.
- October 23, 2014 *College of William and Mary* (Williamsburg - VA, USA).
 - Talk title: QCD dynamics at high-energy: linear and non-linear evolution equations.
- October 22, 2014 *Thomas Jefferson National Accelerator Facility (JLAB)* (Newport News - VA, USA).
 - Talk title: Hierarchy of non-linear evolution equations of Wilson lines at next-to-leading order.
- January 16, 2014 *Institute for Nuclear Theory (INT)* (Seattle - WA, USA).
 - Talk title: Linear and Non-linear High-Energy QCD Dynamics including NLO and Higher-Order Corrections.
- December 02, 2013 *Thomas Jefferson National Accelerator Facility (JLAB)* (Newport News - VA, USA).
 - Talk title: Solution of the NLO BFKL Equation.
- December 11, 2012 *Università della Calabria* (Cosenza, Italy).
 - Talk title: Linear and Non-linear Dynamics of Quantum Chromodynamics at High-Energy.
- July 08, 2011 *Brookhaven National Laboratory* (Upton - NY, USA).
 - Talk title: High-energy Amplitudes and Impact Factors at next-to-leading-order.
- May 19, 2011 *European Centre for Theoretical Studies in Nuclear Physics and Related Areas* (Trento, Italy).
 - Talk title: Non linear dynamics of the structure of hadronic matter at high-energy.
- December 16, 2010 *Bielefeld University* (Bielefeld, Germany).
 - Talk title: Scattering Amplitudes and Evolution Equations at High-Energy.
- March 19, 2010 *Oulu University* (Oulu, Finland).
 - Talk title: The Structure of the Hadronic Matter at high-energy.
- January 27, 2010 *Lawrence Berkeley National Laboratory* (Berkeley - CA, USA).



- Talk title: High-energy evolution of amplitudes in gauge theories in the next-to-leading order.
- June 26, 2009 *Brookhaven National Laboratory* (Upton - NY, USA).
 - Talk title: NLO evolution of Color Dipole in QCD and $\mathcal{N} = 4$ SYM.
- January 6, 2009 *Laboratoire de Physique Théorique d'Orsay* (Université Paris-Sud 11, Paris, France).
 - Talk title: NLO evolution of Color Dipole in QCD and $\mathcal{N} = 4$ SYM.

Publications

Total citations counted in INSPIRE as of 20 April 2022

- Published: 1298 (h-index 14)
- Citeable: 1950 (h-index 15)

Link to my publications in INSPIRES

1. I. Balitsky and G. A. Chirilli,
“Rapidity evolution of TMDs with running coupling”
in preparation
2. Giovanni Antonio Chirilli,
“Pseudo and quasi gluon PDF in the BFKL approximation”,
JHEP **03** (2022) 064 [arXiv: 2111.12709 [hep-ph]].
3. Giovanni Antonio Chirilli, *10 citations*
“High-energy Operator Product Expansion at sub-eikonal level”,
JHEP **06** (2021), 096 [arXiv:2101.12744 [hep-ph]].
4. Giovanni Antonio Chirilli, *38 citations*
“Sub-eikonal corrections to scattering amplitudes at high energy”,
JHEP **1901**, 118 (2019) [arXiv:1807.11435 [hep-ph]].
5. I. Balitsky and G. A. Chirilli, *8 citations*
“Conformal invariance of transverse-momentum dependent distributions rapidity evolution”,
Phys. Rev. D **100** (2019) no.5, 051504 [arXiv:1905.09144[hep-ph]].
6. Giovanni A. Chirilli, Yuri V. Kovchegov, Douglas E. Wertepny *11 citations*
“Regularization of the Light-Cone Gauge Gluon Propagator Singularities Using Sub-Gauge Conditions”, JHEP **1512**, 138 (2015) [arXiv:1508.07962[hep-ph]].
7. Giovanni A. Chirilli, Yuri V. Kovchegov, Douglas E. Wertepny *22 citations*
“Classical Gluon Production Amplitude for Nucleus–Nucleus Collisions: First Saturation Correction in the Projectile”, JHEP **1503**, 015 (2015) [arXiv:1501.03106[hep-ph]].

8. Giovanni A. Chirilli and Yuri V. Kovchegov *27 citations*
 “ $\gamma^* \gamma^*$ Cross Section at NLO and Properties of the BFKL Evolution at Higher Orders”,
 JHEP **1405**, 099 (2014) [arXiv:1403.3384 [hep-ph]].
9. I. Balitsky and G. A. Chirilli, *114 citations*
 “Rapidity evolution of Wilson lines at the next-to-leading order”,
 Phys. Rev. D **88**, (2013) 111501 [arXiv:1309.7644 [hep-ph]].
10. Giovanni A. Chirilli and Yuri V. Kovchegov, *30 citations*
 “Solution of the NLO BFKL Equation and the Strategy for Solving the All-Order BFKL Equation”,
 JHEP **1306**, 055 (2013) [arXiv: 1305.1924[hep-ph]].
11. I. Balitsky and G. A. Chirilli, *99 citations*
 “Photon impact factor and k_T -factorization for DIS in the next-to-leading order”,
 Phys. Rev. D **87**, (2013) 014013 [arXiv: 1207.3844[hep-ph]].
12. Giovanni A. Chirilli, Bo-Wen Xiao and Feng Yuan, *152 citations*
 “Inclusive Hadron Productions in pA Collisions”,
 Phys. Rev. D **86** (2012) 054005 [arXiv: 1203.6139 [hep-ph]].
13. Giovanni A. Chirilli, Bo-Wen Xiao and Feng Yuan, *135 citations*
 “One-loop Factorization for Inclusive Hadron Production in pA Collision in the Saturation Formalism”,
 Phys. Rev. Lett. **108**, 122301 (2012) [arXiv: 1112.1061 [hep-ph]].
14. G. A. Chirilli, L. Szymanowski and S. Wallon, *15 citations*
 “Uncovering the triple Pomeron vertex from Wilson line formalism”,
 Phys. Rev. D **83**, 014020 (2011) [arXiv: 1010.0285 [hep-ph]].
15. I. Balitsky and G. A. Chirilli, *104 citations*
 “Photon impact factor in the next-to-leading order”,
 Phys. Rev. D **83**, 031502 (2011) [arXiv: 1009.4729 [hep-ph]].
16. I. Balitsky and G. A. Chirilli, *50 citations*
 “High-energy amplitudes in $\mathcal{N}=4$ SYM in the next-to-leading order”,
 Phys. Lett. B **687**, 204 (2010) [arXiv: 0911.5192 [hep-ph]].
17. I. Balitsky and G. A. Chirilli, *90 citations*
 “NLO evolution of color dipoles in $\mathcal{N}=4$ SYM”,
 Nucl. Phys. B **822**, 45 (2009) [arXiv: 0903.5326 [hep-ph]].
18. I. Balitsky and G. A. Chirilli, *33 citations*
 “Conformal kernel for NLO BFKL equation in $\mathcal{N}=4$ SYM”,
 Phys. Rev. D **79**, 031502 (2009) [arXiv: 0812.3416 [hep-ph]].
19. I. Balitsky and G. A. Chirilli, *354 citations*
 “Next-To-Leading Order Evolution Of Color Dipoles”,
 Phys. Rev. D **77**, 014019 (2008) [arXiv: 0710.4330 [hep-ph]].



Proceedings

1. Y. Hatta, Y. V. Kovchegov, C. Marquet, A. Prokudin, E. Aschenauer, H. Avakian, A. Bacchetta, D. Boer, G. A. Chirilli and A. Dumitru, *et al.*
“Proceedings, Probing Nucleons and Nuclei in High Energy Collisions: Dedicated to the Physics of the Electron Ion Collider: Seattle (WA), United States, October 1 - November 16, 2018,” doi:10.1142/11684 [arXiv:2002.12333 [hep-ph]].
2. G. A. Chirilli, A. M. Stasto, T. Ullrich and B. W. Xiao,
“Summary of Weeks V & VI,”
doi:10.1142/9789811214950_0052
3. G. A. Chirilli “Sub-eikonal spin corrections and g_1 structure function at low- x ”
PoS DIS 2019 (2019) 253
27th International Workshop on Deep-Inelastic Scattering and Related Subjects (DIS2019)
8-12 April, 2019, Torino, Italy.
4. G. A. Chirilli, “OPE in Wilson lines with sub-eikonal spin corrections for TMDs and g_1 structure function”
9th International Workshop on QCD - Theory and Experiment (QCD@Work 2018) EPJ Web Conf. **192**, 00013 (2018). doi:10.1051/epjconf/201819200013.
5. G. A. Chirilli, “Non-linear dynamics in DIS at NLO,” PoS DIS **2017**, 066 (2018).
25th International Workshop on Deep-Inelastic Scattering and Related Topics (DIS 2017)
03-07 April 2017, Birmingham, UK.
6. G. A. Chirilli, “Classical gluon production amplitude in heavy-ion collisions,”
EPJ Web Conf. **129**, 00031 (2016) doi:10.1051/epjconf/201612900031
7. G. A. Chirilli, “Sub-gauge Conditions for the Gluon Propagator Singularities in Light-Cone Gauge” PoS QCDEV2016 (2017) 038. QCD Evolution Workshop (QCD 2016) May 30 - June 3, 2016, Amsterdam, Netherlands.
8. G. A. Chirilli “Classical gluon production amplitude in heavy-ion collisions”,
published in EPJ-web of Conferences.
6th International Conference on Physics Opportunities at an Electron-Ion Collider (POETIC VI) September 07 - 11, 2015, École Polytechnique, Palaiseau, France.
9. G. A. Chirilli “Non-Linear QCD Dynamics and Wilson Lines”, PoS QCDEV2015 (2015) 033.
QCD Evolution Workshop May 26 - 30, 2015, Thomas Jefferson National Accelerator Facility, Newport News, VA.
10. G. A. Chirilli “High-energy evolution of Wilson lines at the next-to-leading order”, Nucl. Phys. A, **931**, November 2014, Pages 1130-1135.
XXIII International Workshop on Deep-Inelastic Scattering 27 April - May ,1 2015, Dallas, Texas.
11. G. A. Chirilli “Rapidity evolution of Wilson lines at the next-to-leading order: Balitsky-JIMWLK equation at NLO”, Nucl. Phys. A, **931**, November 2014, Pages 1130-1135.
Quark Matter 2014 May 19 - 24, 2014, Darmstadt, Germany.



12. G. A. Chirilli "Solution of the next-to-leading order BFKL equation", Int. J. Mod. Phys. Conf. Ser. **25**, 1460026 (2014).
QCD Evolution Workshop *May 06 - 10, 2013, Thomas Jefferson National Accelerator Facility, Newport News, VA.*
13. G. Chirilli, B. -W. Xiao and F. Yuan, "The NLO inclusive forward hadron production in pA collisions," Nucl. Phys. A **904-905**, 841c (2013).
23rd International Conference on Ultra-Relativistic Nucleus-Nucleus Collisions (Quark Matter 2012) *August 13 - 18, 2012, Washington, DC, USA.*
14. G. A. Chirilli "High-Energy QCD factorization from DIS to pA collisions", Int. J. Mod. Phys. Conf. Ser. **20**, 200 (2012) [arXiv: 1209.1614 [hep-ph]].
QCD Evolution Workshop *May 14 - 17, 2012, Thomas Jefferson National Accelerator Facility, Newport News, VA.*
15. G. Chirilli, B. -W. Xiao and F. Yuan, "The NLO inclusive forward hadron production in pA collisions," Int. J. Mod. Phys. Conf. Ser. **20**, 208 (2012).
QCD Evolution Workshop *May 14 - 17, 2012, Thomas Jefferson National Accelerator Facility, Newport News, VA.*
16. G. A. Chirilli "Photon impact factor for BFKL pomeron at next-to-leading order", 20th International Workshop on Deep-Inelastic Scattering and Related Subjects (DIS 2012) *March 26 - 30, 2012, Bonn, Germany.*
17. D. Boer, M. Diehl, R. Milner, R. Venugopalan, W. Vogelsang, D. Kaplan, H. Montgomery, S. Vigdor, A. Accardi and E. C. Aschenauer, *et al.*
"Gluons and the quark sea at high energies: Distributions, polarization, tomography," [arXiv:1108.1713 [nucl-th]].
18. G. A. Chirilli, "The photon impact factor for DIS at NLO: Analytic result" AIP Conf. Proc. **1350**, 228 (2011).
6th International Workshop on Diffraction in High Energy Physics (Diffraction 2010) *September 10 - 15 2010, Otranto, Lecce, Italy.*
19. G. A. Chirilli "Next-to-leading order structure functions for DIS off a large nucleus", J. Phys. G **38**, 124065 (2011).
22nd International Conference on Ultra-Relativistic Nucleus-Nucleus (Quark Matter 2011) *May 23 - 28, 2011, Annecy, France.*
20. G. A. Chirilli "NLO evolution of structure functions at small x", Int. J. Mod. Phys. Conf. Ser. **4**, 46 (2011).
QCD Evolution Workshop: From Collinear to Non-Collinear Case *April 8 - 9, 2011, Thomas Jefferson National Accelerator Facility, Newport News, VA.*
21. G. A. Chirilli, "Analytic NLO photon impact factor for deep inelastic scattering," PoS ICHEP **2010**, 129 (2010).
35th International Conference on High Energy Physics (ICHEP 2010) *July 21 - 28, 2010, Paris, France.*



22. G. A. Chirilli "High-energy amplitudes and impact factors at next-to-leading order",
PoS(DIS 2010), 063, 2010 [arXiv: 1007.0036 [hep-ph]].
18th International Workshop on Deep Inelastic Scattering and Related Subjects (DIS 2010)
April 19 - 23, 2010, Florence, Italy.
23. G. A. Chirilli "Small-x Evolution in the Next-to-Leading Order",
Mod. Phys. Lett. A **24**, 3052 (2009) [arXiv: 1001.2742 [hep-ph]].
Workshop on Recent Advances in Perturbative QCD and Hadronic Physics *July 20 - 25, 2009, Trento, Italy.*
24. G. A. Chirilli "Small-x evolution of structure functions in the next-to-leading order" AIP Conf. Proc. **1182**, 913 (2009).
10th Conference on the Intersections of Particle and Nuclear Physics (CIPANP 2009) *May 26 - 31, 2009, San Diego, California.*
25. G. A. Chirilli "Small-x evolution of structure functions in the next-to-leading order",
DESY-PROC-2009-03, JLAB-THY-09-982. International Conference on the Structure and the Interactions of the Photon including the 18th International Workshop on Photon-Photon Collisions and the International Workshop on High Energy Photon Linear Colliders (Photon 2009) *11-15 May 2009, Hamburg, Germany.*
26. G. A. Chirilli, "NLO Evolution of Color Dipoles in $N = 4$ SYM",
AIP Conf. Proc. **1105**, 331 (2009) [arXiv: 0811.3642 [hep-ph]].
5th International Workshop on Diffraction in High Energy Physics (Diffraction 2008)
September 9 - 14 2008, La Londe-les-Maures, France.
27. I. Balitsky and G. A. Chirilli, "NLO Evolution of Color Dipoles",
Acta Phys. Polon. Supp. **1**, 545 (2008).
8th Workshop on Continuous Advances in QCD (CAQCD-08) *May 15 - 18 2008, Minneapolis, Minnesota.*
28. I. Balitsky and G. A. Chirilli, "NLO Evolution of Color Dipole",
Acta Phys. Polon. B **39**, 2561 (2008).
Summer School on QCD, Low X Physics, Saturation and Diffraction *July 1 - 14 2007, Calabria, Italy.*
29. C. Coriano, G. Chirilli and M. Guzzi, "Using and constraining non-forward parton distributions: Deeply virtual neutrino scattering in cosmic rays and light dark matter searches", [arXiv: 0309069 [hep-ph]].
QCD @ Work 2003: 2nd International Workshop on Quantum Chromodynamics: Theory and Experiment *June 14 - 18 2003, Conversano, Italy.*

Research Statement

Giovanni Antonio Chirilli

1 State-of-the-art and objectives

Understanding the fundamental properties of hadrons, like the protons and the neutrons, the building blocks of the visible matter, from the dynamics of their constituents, quarks, and gluons (collectively called partons), is one of the most challenging problems in particle and nuclear physics nowadays [1, 2, 3, 4, 5, 6, 7, 8, 9, 10].

Despite the tremendous effort to understand the finest structure of matter, and the wealth of achievements in that direction, many fundamental questions remain unanswered. The origin of the proton's spin from its constituents is a remarkable example. A community effort is represented by the Electron-ion Collider (EIC) project in the U.S., the world's first polarized electron-proton collider, which will help us gain a deeper understanding of the role played by quarks and gluons in generating the fundamental properties of the proton like its spin.

To succeed, every experiment has to be supported by a strong theoretical framework. Partons dynamics, governed by one of the four fundamental forces of nature, the strong force, can be studied, within the theory of Quantum Chromodynamics (QCD), through the calculation of cross-sections, which are intimately related to the probability that certain events may happen in scattering processes. Confinement and asymptotic freedom are two important features of QCD. The first, confinement, expresses the impossibility of having unbound state of the degrees of freedom, quarks and gluons. The second, asymptotic freedom, allows one to consider quarks and gluons as free particles undergoing high energy or high momentum transfer in scattering processes.

In QCD, hard processes are characterized by at least two energy scale: one is represented by the hadron size, and the other one is the *hard scale*, typically greater than 1GeV^2 , represented by the momentum transfer. A typical hard process is deep inelastic scattering (DIS) in which the momentum transfer, q^2 , is the virtuality of the exchanged photon (or vector boson). At high momentum transfer we can calculate cross-sections using perturbative methods. Through factorization theorems, we can isolate the non-perturbative part of the process represented by quark and gluon distributions which, being universal, can be calculated from one process and used to predict others.

At high center-of-mass energy (Regge limit) the density of partons in nucleons grows exponentially, and to avoid violation of unitarity (conservation of probability), the density increases until it reaches a plateau called *saturation region*. One of the goal is to develop a formalism to study the spin content of the nucleons in terms of their constituents at such high energy and high density regime.

Well known factorization schemes are the collinear factorization and the k_T -factorization. These two factorization schemes are relevant when the hadronic matter is probed at two different limits: the Bjorken limit and the Regge (high-energy or small- x_B) limit. Collinear factorization is applied in the Bjorken limit where the dynamics of the process is governed by incoherent interactions (see left panel of figure 1). The virtual photon interacts incoherently with one of the constituents of the hadronic target: in first approximation, while the virtual photon interacts with one of the partons, the interaction among the other partons, can be neglected. Instead, k_T -factorization is relevant at high-energy (Regge) limit where the dynamics of the process is dominated by coherent interactions due to the high density of partons in the target. High-energy DIS is best studied in the dipole model [11, 12] where the virtual photon, long before scattering off the target, splits in a quark-antiquark pair (see right panel of figure 1).

The theory of strong interactions at high-energy (Regge) limit corresponds to the study of scattering amplitudes with the center-of-mass energy much larger than all the other scales involved in the process. In this case, the use of perturbation theory is possible if there exists an intrinsic scale, the saturation scale, which, although much smaller than the center-of-mass energy, is well above the typical confinement region. At this regime, non-linear effects dominate the dynamics of hadronic matter.

To study DIS in collinear factorization (Bjorken limit), one considers the time ordered product (T-product) of two electromagnetic currents through the expansion in terms of in local operators. The local OPE can be reformulated in terms of light-ray operators with the advantage of preserving explicitly the Lorentz and conformal invariance of the theory and also providing a gauge covariant technique to separating higher twist contribution (see for example [13] it was shown that). Hence, in the Bjorken limit one introduces a factorization scale, which cuts the transverse momenta of the gluon fields, and may expand the T-product of two electromagnetic



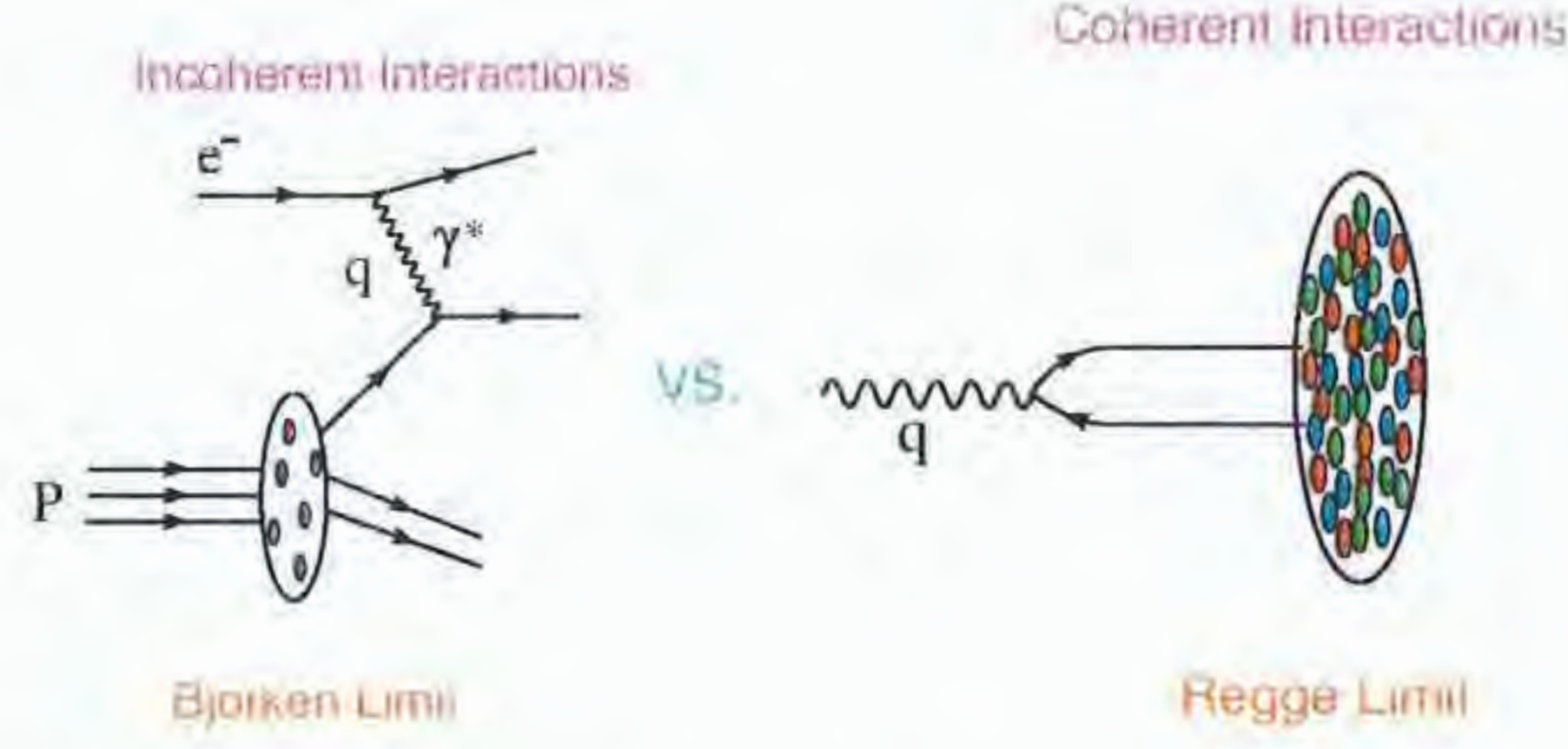


Figure 1: The figure on the left shows a typical interaction in DIS where the virtual photon interacts incoherently with one of the constituents of the hadronic target. The figure on the right, instead, shows how the dipole model is more suitable for coherent interactions, that is when the density of constituents in the hadronic target is high.

currents, which encode the hadronic content of the entire DIS process, in terms of coefficient functions, and matrix elements of the light-ray operators. The evolution equation of the light-ray operators with respect to the factorization parameter is the DGLAP evolution equation which resums contribution of the type $\ln \frac{Q^2}{\Lambda_{QCD}^2}$. Here $Q^2 = -q^2$ is the virtuality of the photon exchanged in DIS process which resolves partons having transverse size of the order of $\frac{1}{Q}$. The higher is Q^2 the smaller are the partons resolved in the hadronic target in the transverse space. Thus, DGLAP is an evolution of the parton density towards a dilute system (see figure 2). The diagrammatic representation of the OPE in terms of light-ray operators is given in figure 3.

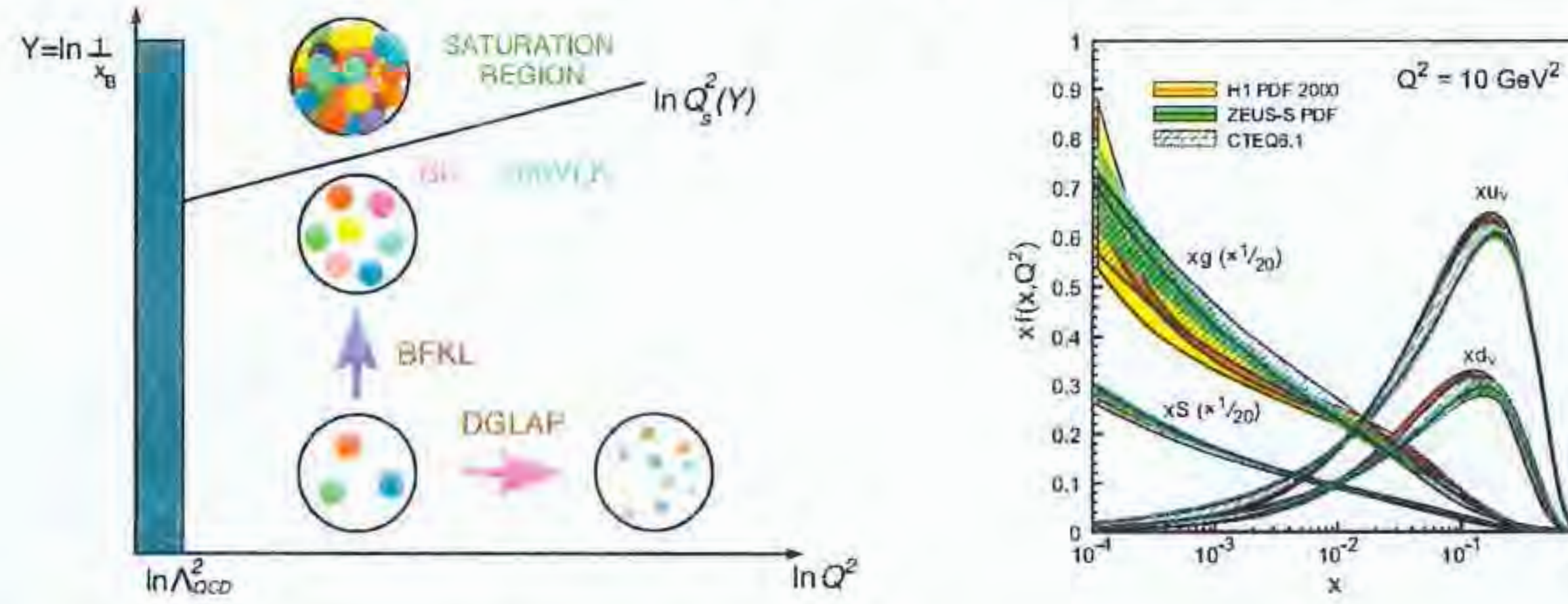


Figure 2: Left panel shows a phase diagram of the parton density of the hadronic target when probed at two different regimes. DGLAP evolution equation describes an evolution towards a dilute system as the power resolution Q^2 increases. BFKL equation is an evolution towards a dense system since the power resolution of the virtual photon is fixed while the energy increases generating more parton fluctuations. To avoid breaking of unitarity the density is tamed by non-linear dynamics: the evolution equation becomes non linear. The line separating the dilute regime from the dense saturated regime is the saturation scale which grows with energy. The right panel shows a fit of the HERA data. The gluon distributions, which are scaled down by a factor of 20, drives the dynamics at low values of Bjorken- x .

At high energy (Regge) limit, it is convenient to factorize the amplitude in rapidity space since the fields of the colliding particles are ordered according to their rapidity. Similarly to the collinear factorization, in which one introduces a scale to distinguish the perturbative contributions from the non-perturbative ones, at high energy, the fields now ordered in rapidity, are separated in *slow* and *fast* fields by the rapidity factorization scale. In this way, one may factorize the high-energy scattering amplitude into coefficient functions, as a result of integration over the slow fields, and into matrix elements of the operators obtained from the integration over the fast fields. This is the logic of the Operator Product Expansion (OPE) at high-energy. The diagrammatic representation of the high-energy OPE is shown in figure 4. The main difference from the collinear factorization

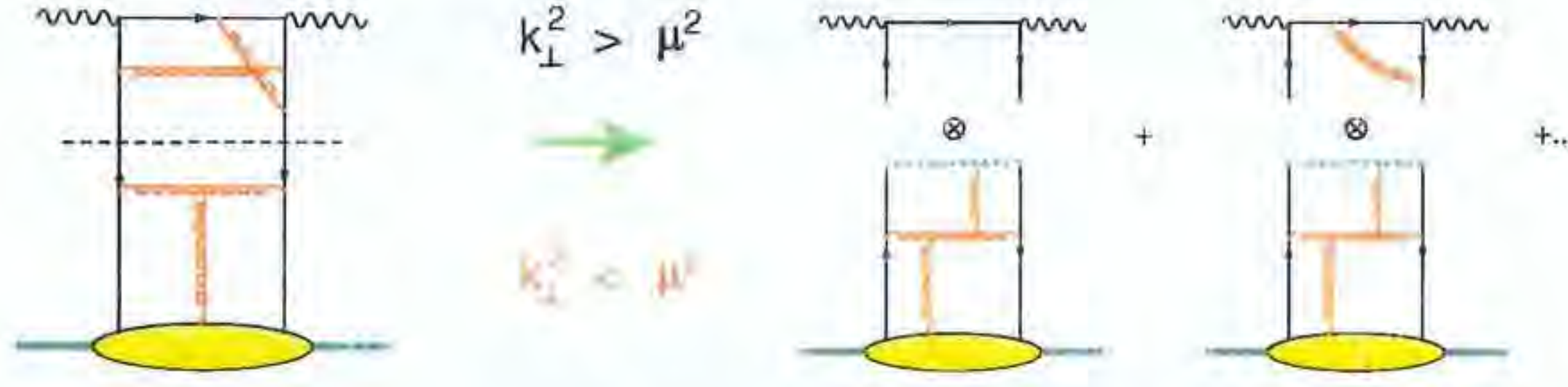


Figure 3: Diagrammatic representation of the OPE in terms of light-ray operators. Diagram on the left of the green arrow is the DIS amplitude, and the black dashed line on it represents the factorization μ^2 . On the right side, the two top diagrams are the coefficient functions which are convoluted with the light-ray operators represented by the dotted blue lines.

is that at high-energy the coefficient functions and the matrix elements both contains perturbative and non-perturbative contributions. The latter, however, are screened by the *saturation scale*, which is much larger than the scale which characterizes the confinement region, thus justifying the applicability of perturbative methods. The saturation scale is the scale at which the non-linear dynamics of the process takes place. The theory of high energy and high parton density is the Color Glass Condensate (CGC). The term “color” refers to the charge that quarks and gluons carry. The term “glass” refers to the two time scale interactions typical of hadronic scattering where partons are time dilated. The term “Condensate”, instead, refers to the high density of gluons (for a review see [14, 15, 16, 17]).

Natural operators for the description of amplitudes at high-energy are *Wilson lines*: infinite gauge factors ordered along the straight line collinear to the particle’s velocity. Evolution equations of Wilson lines provide the energy dependence of the amplitude. Each step in rapidity generates a new Wilson line at a different point in impact parameter space. This feature makes the evolution equation of Wilson lines to be non-linear. Known evolution equations at high-energy are the Balitsky-Kovchegov (BK) equation [18, 19], the Balitsky-hierarchy of coupled evolution equations [18], the Jalilian-Marian, Iancu, McLerran, Weigert, Leonidov and Kovner (JIMWLK) equation [20, 21, 22, 23] and the Balitsky-Fadin-Kuraev-Lipatov (BFKL) equation [24, 25].

The BFKL equation provides the leading log resummation (resummation of terms proportional to the strong coupling constant and the logarithm of the center-of-mass energy s : $\alpha_s \ln \frac{s}{s_0}$) of the scattering processes at high-energy (Regge limit). Because of its linearity, BFKL violates unitarity since it describes only the proliferation of partons. On the other hand evolution equations obtained in a semi-classical (shock-wave) formalism through Wilson lines operators, are non-linear and thus respect unitarity: the non-linear term in the equation describes the recombination process that tames the growth of the parton density beyond the unitarity limit.

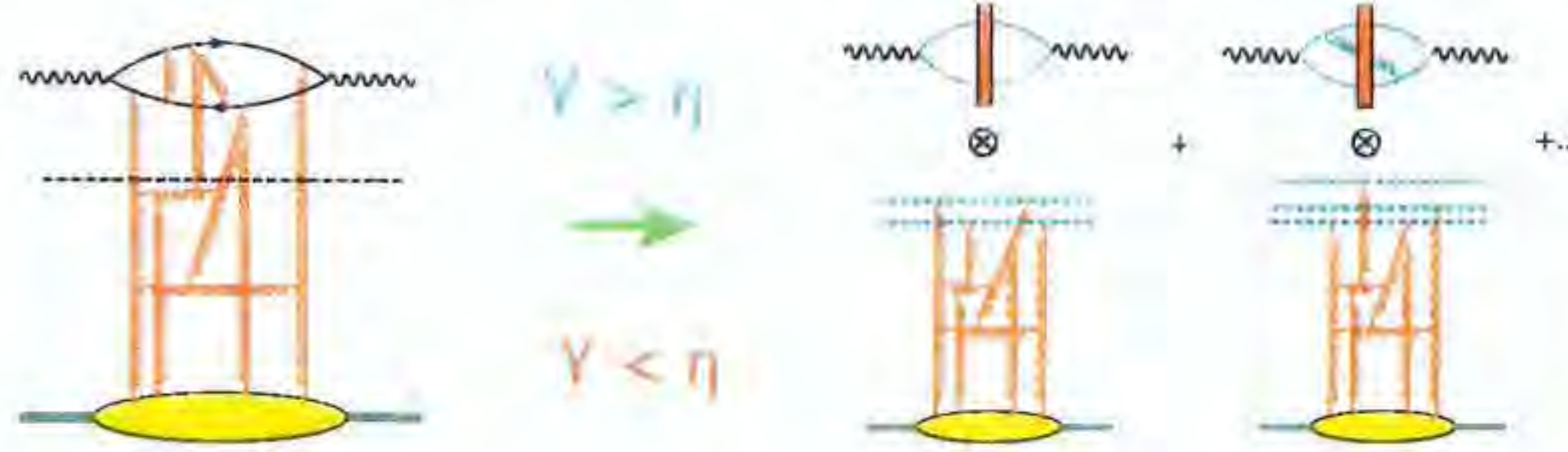


Figure 4: Diagrammatic representation of the high-energy OPE of the T-product of two electromagnetic currents. The dashed line on the diagram in the left panel represents the rapidity factorization scale η . On the right panel, the two diagrams on the top are the coefficient functions (impact factors) which are convoluted with matrix elements of infinite Wilson lines represented by dotted blue lines.

Scattering amplitudes at high-energy (Regge) limit, are dominated by gluon dynamics (see right panel of figure 2 for an experimental evidence of the importance of gluons at high-energy, small Bjorken- x), and the unpolarized DIS cross-section is dominated by the gluon structure functions.

The behavior of the polarized DIS structure functions at small- x_B , contrary to the unpolarized ones, is not yet well understood. In the polarized case, the pomeron intercept receives an extra complication due to the

presence of double logarithm of energy $\alpha_s \ln^2 x_B^{-1}$ [26, 27]. Such double logarithms of energy are also present in the unpolarized quark structure function [28, 29], although they are suppressed by one power of energy with respect to the gluon one. In the polarized case, instead, quark structure functions are not suppressed in comparison to the gluon structure functions, thus their behavior at small- x_B becomes relevant.

The fact that the double logarithm of energy, $\alpha_s \ln^2 x_B^{-1}$ cannot be seen from the LO anomalous dimension of twist two operators makes the study of polarized structure functions even more challenging. Indeed, if on one side, the relation at the *non-physical* point $n = 1$ (n being the moment index), between the BFKL and DGLAP was established through the anomalous dimension of twist two operators [30, 31], on the other, such relation cannot be easily obtained in the polarized case due to the presence of double log of energy contributions which are absent in the LO [32] and NLO polarized splitting functions [33, 34]. However, the double log of energy contribution, $\alpha_s \ln^2 x_B^{-1}$, appears at three-loop polarized splitting function [35, 36, 37, 38] and the result is in agreement with the one originally found in Ref. [26, 27].

2 Future directions

Part of my future project is to bring the knowledge of the unpolarized and polarized small- x_B structure functions at the same level. To this end, I have extended the high-energy OPE of the T -product of two-electromagnetic currents to include terms that are not symmetric in the exchange of the two Lorentz indexes of the DIS hadronic tensor [39] (see figure 6). Indeed, in the polarized DIS both the leptonic tensor and the hadronic one have to be antisymmetric. To obtain antisymmetric contributions in the high-energy OPE, it is necessary to go beyond the eikonal approximation and include sub-eikonal terms. The high-energy OPE with sub-eikonal contributions is given in terms of new operators, thus the task is to calculate their evolution equations. Recently, I have calculated all the diagrams for the evolution equations [39] from which I plan, as part of my future projects, to extract the single and double log of energy contributions and compare them with known results in the literature [26, 27].

An important ingredient to perform the high-energy OPE with sub-eikonal corrections is the quark and gluon propagators with sub-eikonal corrections (see figure 5). In [39] I calculated such corrections as deviation from the shock-wave approximation: the corrections are suppressed by the large Lorentz boost parameter. Corrections to the eikonal approximation can be also included assuming that the fields of the background shock-wave do not have the same transverse momenta but they are ordered in transverse momenta. Indeed, if on one hand in the DGLAP regime the transverse momenta $k_\perp$ of the fields are ordered (see figure 3), on the other, in the high-energy (BFKL) limit they are not. In order to build a bridge between two well developed but, apparently, not overlapping formalisms, one can consider deviation from the shock-wave (eikonal) approximation including corrections obtained considering ordering in $k_\perp$ in the shock-wave fields. I plan to tackle this problem first in the unpolarized case and then extend the formalism to the polarized one. The first step will be to include such corrections to the quark and gluon propagators I calculated in [39] and then, extend the high-energy OPE including these new corrections first in the impact factors (intimately related to the DIS structure functions) and then to the evolution equations of the matrix elements of the new operators thus obtained. In this case, the sub-eikonal corrections are included as light-cone expansion of the background shock-wave.

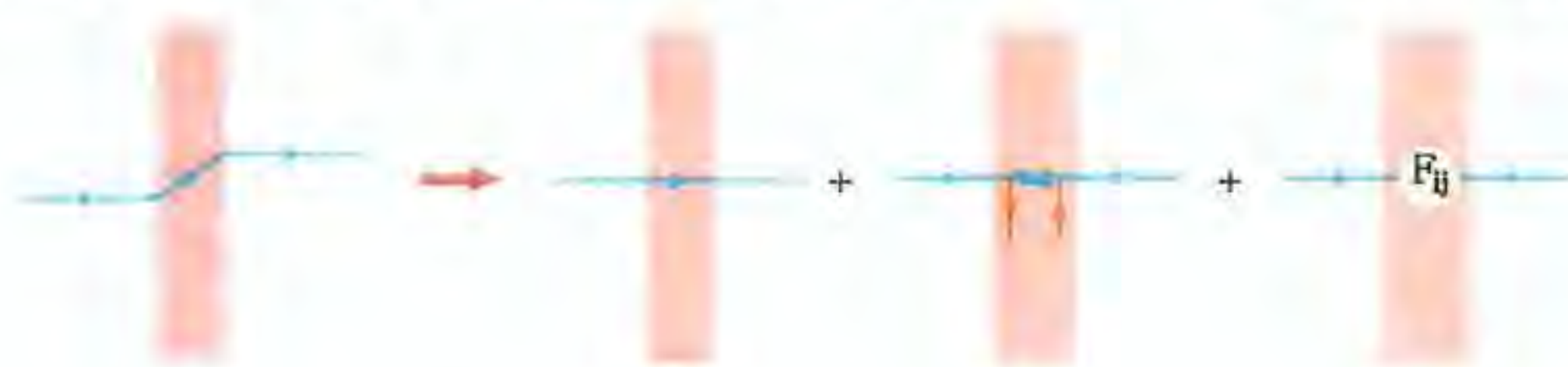


Figure 5: The reddish bands in the figure represent is the shock-wave in which the fields of the target shrink in the direction of the boost. The figure to the left of the red arrow shows the deviation from a straight line of the propagation of a quark in the shock-wave background. The first figure to the right of the red arrow shows the eikonal (straight-line) propagation in the shock-wave while the next two diagrams represent the corrections from eikonal propagation: the first diagram is a correction due to the quarks in the background field which is negligible the eikonal approximation; the second diagram is a gluon sub-eikonal correction.



Figure 6: Diagrams of the LO impact factor with quark-sub-eikonal corrections.

Polarized scattering processes at this regime have been already studied in the literature, but it turns out that the results obtained by different groups are in conflict to each other. Results obtained within the saturation and Color Glass Condensate formalism in Ref. [5, 40, 41, 42, 43] are in disagreement with the ones obtained in the double logarithm approximation in the Refs. [28, 26, 27]. Let us recall that the goal is not that of re-obtaining old results using a new formalism, but the new formalism brings in the non-linear feature characteristic of high-energy QCD scatterings and which is not contemplated by the usual Leading Log or Double Log of energy resummation. Indeed, like the BK equation, as we have seen, in its linear approximation reproduces the BFKL evolution equation, in the same way, the evolution equation obtained with Wilson lines formalism for polarized scatterings should not only reproduce the Leading Log or Double Log of energy resummation but also extend it to include the non-linear dynamics.

The groundbreaking nature of the project can be seen in the applications of the high-energy OPE to the study of high-energy polarized scattering processes like DIS. This method allows one to study the scattering amplitude in a more rigorous way. Indeed, in Refs. [39, 44] I have shown how to obtain the relevant new operators, which encode the polarized parton dynamics, in a gauge covariant way. With the high-energy OPE applied to DIS I have obtained new impact factors, defined new quark and gluon distributions, and calculated all the diagrams for new evolution equations.



Figure 7: Sample of new diagrams I calculated in [44]. The implication of these diagrams to polarized DIS is part of my future research activity.

- *Impact Factors for Polarized DIS*

In the unpolarized case the impact factors are known at LO [25] and at NLO [45, 46]. In the polarized case, instead, the impact factors (see figure 6) have been calculated for the first in my last paper in Ref.[44]. I plan to use the polarized impact factors and the evolution equations of the sub-eikonal corrections (as a byproduct we also obtained the energy suppressed unpolarized impact factor) to compare with fixed order calculation of the DIS cross-section performed in the Bjorken limit (*DGLAP regime*). Indeed, such comparison can only be done at the level of cross section. Finding an agreement between the two formalisms, which are valid at two different kinematic regimes, is important not only from a pure theoretical point of view but also from a phenomenological point of view because these results will be relevant to make predictions at, for example, the future Electron-Ion Collider experiment.

- *New Feynman Diagrams in the shock-wave background I calculated in [44]*

In high-energy and high-parton density QCD, the impact factors and all the Feynman diagrams needed to calculate the evolution equations were never calculated before. In order to have a complete understanding of the dynamics of partons and proton's spin at such complicated non-linear regime one has to consider all the diagrams contributing at one loop order. Recently, I calculated all the possible diagrams, including those never considered before (see figure 7), necessary for the non-linear evolution equations for spin structure

functions. I have shown that the results in the literature [5, 40, 41, 42, 43], on which phenomenological studies have been performed [47], miss contributions that instead I have calculated. I plan to investigate the implications of the new results obtained in [44]. In particular, after disentangling the single log of energy from the double ones, I plan to complete all the steps required by the OPE, *i.e.* solve the evolution equations and convolute them with the impact factors in order to get the g_1 structure function behavior at high-energy (small- x_B). To this end it will be necessary to evaluate the matrix elements of the new operators in the McLerran-Venugopalan (MV) or GBW models [48, 49, 50].

- *New quark and gluon distributions I obtained in [44]*

Within the high-energy OPE, I obtained several quark and gluon distributions that have never been obtained before in hadron physics. Understanding the relation between these new quark and gluon distributions and the known ones is part of my future research activity. As an example here I report only four of the new distributions

$$\int d^2\Delta e^{i(\Delta,k)} \langle \langle P, S | [Q_5(x_\perp) \text{Tr}\{U_x U_y^\dagger\} + \text{a.c.}] | P, S \rangle \rangle = \frac{s}{2} \left(\lambda q_{5L}(k_\perp^2, x) - \frac{(S, k)_\perp}{M} q_{5T}(k_\perp^2, x) \right), \quad (1)$$

$$\int d^2\Delta e^{i(\Delta,k)_\perp} \langle \langle P, S | [\hat{\mathcal{F}}(x_\perp) U^\dagger(y_\perp)] + \text{a.c.} | P, S \rangle \rangle = \frac{s}{2} \left[\lambda \frac{k_\perp^2}{M^2} G_L(k_\perp^2, x) + \frac{(S, k)_\perp}{M} G_T(k_\perp^2, x) \right], \quad (2)$$

with helicity $\lambda = \pm \frac{1}{2}$. In (1) and (2), $q_{5L}(k_\perp^2, x)$, $q_{5T}(k_\perp^2, x)$, $G_L(k_\perp^2, x)$, and $G_T(k_\perp^2, x)$ are the polarized longitudinal and transverse quark and gluon distributions (M target mass) respectively. The Wilson line at transverse position $x_\perp$ is denoted as U_x and Tr here indicates trace in the fundamental representation. In eq. (1) the operator $\hat{Q}_5(x_\perp)$ is the quark light-ray (cone) operator with γ^5 for the parity-odd operator, while the operator $\hat{\mathcal{F}}(x_\perp)$ is a light-ray operator with the insertion of the $\varepsilon^{ij} F_{ij}(x_\perp)$ operator.

- *Bridge between the collinear and high-energy factorization*

Ideally, one would like to build a formalism valid at small as well as moderated values of x_B . To this end, I plan to extend the results obtained in [39] to include sub-eikonal corrections arising from considering the transverse momenta of the background *fast* fields $l_\perp$ much smaller than the characteristic transverse momenta $p_\perp$ of the quantum *slow* fields. Indeed, we know that in the BFKL regime the transverse momenta of the gluon ladder are all of the same order while the longitudinal components are strongly ordered. If we want to extend the shock-wave Wilson-line formalism to moderate x_B , we have to consider the deviation from eikonal approximation not only due to the large but finite Lorentz boost, but due to the ordering in transverse momenta of the background field. Besides the sub-eikonal corrections for the quark and gluon propagators calculated in [39], I plan to include also these new type of corrections. As a result, I will be able to extend the work I did in [44] with other new impact factors and matrix elements of other new operators.

Work in this direction has already been done in Ref. [51, 52] for the evolution gluon Transverse Momentum Distribution (TMD). What was not considered are the corrections to the quark propagators which are essential for the calculation of the DIS structure functions. In Refs. [53, 54] this problem was considered in momentum space but the results obtained are not conclusive and the formalism is not suitable to have gauge invariance under control. The operatorial formalism that I plan to use makes the calculation gauge covariant from the beginning.

- *Behavior of polarized quark and gluon quasi-pdf at small- x_B : correlation functions of light-ray operators*

In recent years a considerable effort has been devoted to the calculation of parton distribution functions on the lattice [55, 56, 57, 58, 59]. The possibility to perform the calculation of parton distributions on the Lattice comes from observing that bi-local operators with space like separation and connected by a Wilson line can be related to the physical PDFs in the large momentum limit, $P \rightarrow \infty$, and higher twist corrections are suppressed by inverse power of P [55]. I recently calculated the behavior of the gluon pseudo- and quasi-pdf at small- x_B [60] for the unpolarized case. The calculation was obtained using correlation functions with light-ray operators with “quasi-pdf frame” (see figure 8), and performing the saddle-point approximation which capture the full BFKL dynamics. Calculating the leading and the next-to-leading residue I also obtained the behavior of the leading and next-to-leading twist of the gluon pseudo- and quasi-pdf distribution at small- x_B . To this hand, it was necessary to consider the set of twist-two multiplicatively renormalizable operators (a super-multiplet) in $\mathcal{N}=4$ SYM theory [61, 62], to consider the analytic continuation to non-integer spin j ,



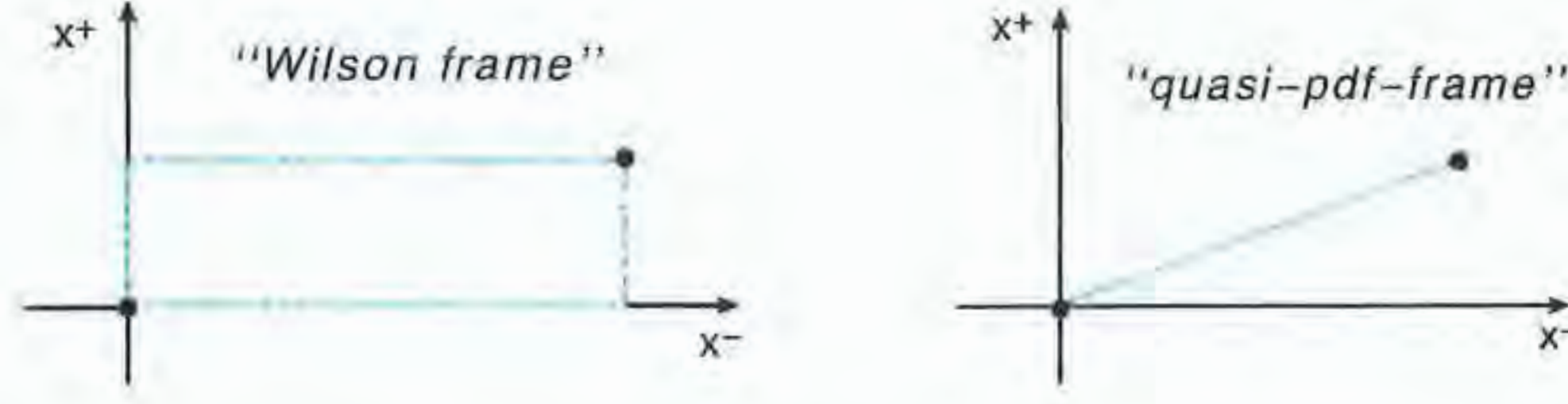


Figure 8: Figure in left panel shows a Wilson-frame. It reminds us a dipole with transverse distance. Figure in right panel shows a straight gauge link for the quasi-pdf. Both gauge-link configurations regulate UV divergences and allow the calculation of correlation functions in the high-energy (BFKL) limit.

and to calculate the correlation functions in the BFKL limit *i.e.* in the limit of $j \rightarrow 1$ which corresponds to the so-called unphysical point in which the twist-two gluon (and quark) operator $F_{\mu+}^a \nabla_+^{j-2} F_+^{\mu a}$ becomes a light-ray operator [63, 31].

Important intermediate step was the calculation of the correlation function of light-ray operators of the type $\int dx^+ (x^+)^{1-j} \mathcal{F}^j(x^+, x_\perp)$ with

$$\mathcal{F}^j(x^+, x_\perp) = \int dy^+ F^{a+\mu}(x^+, y^+, x_\perp) [(x^+ + y^+)n, y^+ n]_x^{ab} F^{b+\mu}(y^+ n + x_\perp) \quad (3)$$

with $[(x^+ + y^+)n, y^+ n]_x^{ab}$ a gauge link at fixed transverse position $x_\perp^\mu$ in the adjoint representation, and with n^μ a light-cone vector (see right panel in figure 8). Calculations of correlation functions with light-ray operators have dragged a lot of attention in recent years [64, 65, 66, 67].

The extension of this result to the polarized case is part of my future project. The challenge will be the calculation of the correlation functions in the BFKL limit including the super-multiplet of operators relevant for spin.

- *NLO polarized evolution equation: running coupling*

The NLO BK equation [68] was calculated to get its region of applicability and to get the argument of the coupling constant which, at LO, is left undetermined and is set by hand to be the saturation scale. For the same reason, it will be important to calculate the NLO evolution equations for the polarized case starting from the diagrams contributing to the running of the coupling. My research activity includes NLO calculations within the Wilson-line formalism in several cases, so my experience in the calculation of the NLO polarized evolution equations will be determinant.

2.1 NNLO BK equation

The NNLO BK equation in $\mathcal{N}=4$ SYM has been obtained exploiting the correspondence with the resummation of large non-global logarithms [69]. In order to obtain the corresponding result in QCD one has to include the diagrams contribution to the running of the coupling as well as those diagrams that contribute to the evolution kernel with terms which are conformal $SL(2, C)$ invariant in two dimensional coordinate space but that are not included in the $\mathcal{N}=4$ SYM result. In an era of precision physics such result is timely.

The calculation of the NNLO BK eq. in QCD is part of my future research activity.

2.2 Interdisciplinary applications

The BK equation is in the *universality class* of the **Fisher-Kolmogorov-Petrovsky-Piskunov Equation (FKPP)** which has applications in **Statistical Mechanics**. It turns out that the parton evolution in high-energy of QCD is equivalent to a specific branching random walk. Indeed, one can derive the property of the solutions of the BK equation from the solutions of the FKPP equation [70].

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Teaching Statement

Giovanni Antonio Chirilli

April 21, 2022

1 Teaching Philosophy

A sign of every teacher's success is represented by his or her students' ability to use the concepts and the tools learned in the class, not as a consequence of mnemonic exercise, rather as a consequence of critical reasoning.

There is, indeed, a lot of difference between a student educated in a subject and one who only gained mnemonic knowledge in the same subject. This difference can be seen when the gained knowledge has to be implemented in real life.

To avoid mnemonic knowledge, teachers should not load students with notions to be memorized, rather with valid reasons for which, for example, the meaning of a law of physics can be remembered. The concepts that can be related to one's everyday life are easier to be understood.

If the aim is to educate students, then teachers should introduce any new subject in a pedagogical way. If a concept or law of physics is being introduced to the students for the first time, teachers should explain why this new concept is important, what it is good for, how we can think about it in relation to our everyday life. Answering these types of questions will stimulate students' interest in learning this new concept and will give them the motivation to think about it or to know when and why it becomes useful in other situations that do not necessarily belong to the environment in which they learned it in the first place. If students are able to do so, they are certainly getting an education that will last for a long time if not forever.

Clearly, every teacher has his or her own style of teaching which is dictated by his or her personality and background. However, there are some criteria and principles that are common to everybody.

Teachers should establish a fair connection with students encouraging them to actively participate in class with questions that will prevent any misconceptions before it is too late. Students should know that questions are a very important part of the course, especially when asked in class. Usually, a question may either reflect the ability of a student to go beyond what has just been discussed or simply the lack of clarity of the teacher. If students are well aware of this, they will certainly ask questions.

Answering questions is also not a trivial task. Not always a straightforward answer is helpful or useful for students. Sometimes it is better to guide students to get the answer. In this way, they learn how to think critically about an idea and thus, gain intuition about the subject being discussed.

A way to avoid misconceptions is to test students with no more than ten minutes long quizzes periodically given in class. This is an efficient method to have useful feedback to understand whether the topic introduced in class has been properly understood by students, and at the same time, clarify misconceptions before the next topic is introduced.



To avoid any extra and unnecessary stress, quizzes should either not be graded or worth extra credits.

Homeworks are also an important part of a course and they are mainly of two types. The first type of homework is the one that requires straightforward or almost straightforward applications of rules and physical laws learned in class. This type of homework could be, for example, a nice modification of problems solved in class, so that the students will test their level of understanding and will gain self-confidence in utilizing the new concepts just learned. The other type of homework, instead, should make students elaborate on the material learned and therefore are usually a bit more challenging, although not always necessarily so. The students, especially at the graduate level, should not think that all they learned in class is all they are supposed to know; rather they should accept that what they learned is just the tip of the iceberg, but they should see this as the most interesting part of the class because now they have the needed tools to explore beyond what they learned, according to their interests.

In general, the homeworks are important for understanding whether students are making progress towards the desired level of understanding that the teacher is aiming to achieve.

During mid-term or final exams, the students need to show the level of understanding they reached. Some of the problems in an exam should be similar to the one encountered in homework. Since during an exam students are tested not only on a specific topic like in homework, but also on the interplay between different topics, they have the opportunity to work out problems that require different tools, techniques, and concepts in order to understand and solve them. This does not have to be necessarily a difficult task. Usually solving these kinds of problems is rewarding for students because all the things they have learned and that might have seemed unrelated at the beginning, now come into play at the same time. Indeed, with this kind of problems students can test whether they are learning how to think critically on the subject of the course, and if they learn to do so, they will be able to carry on this knowledge for a long time.

2 Teaching development plan

The always higher precision reached in experiments devoted to the study of the hadron dynamics requires the knowledge of very sophisticated theoretical tools. Although the main theoretical framework, Quantum Chromodynamics, has been known for a long time, its implications and richness, make it a fast-developing theory even after fifty years from its conception. A relevant formalism for the description of high-energy QCD dynamics is the Wilson lines formalism and the Operator Product Expansion. I believe that my knowledge and expertise in that formalism may give not only a significant contribution to the current research effort of the Physics Department's faculty members but would also contribute to the creation and/or development of a course in high energy QCD at the Master or Ph.D. level. From this kind of course students have the opportunity not only to enrich their curricula by learning a formalism that has also applicability in other area of research, like Statistical Mechanics, or to be quickly involved in cutting edge research topics, but will also teach them to deal with sophisticated theoretical frame-works, which is an ability that they will find useful in any other contest of their professional career.

Regensburg, 21/04/2022

CURRICULUM VITÆ

MARCO CRISOSTOMI

PRESENT POSITION

From 10/2019 **Postdoctoral researcher @ SISSA**

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EDUCATION AND PAST POSITIONS

10/2017 – 10/2019	Postdoctoral researcher Université Paris Saclay (IPhT, LPT, DAp), France
10/2014 – 10/2017	Postdoctoral researcher Institute of Cosmology and Gravitation, University of Portsmouth, UK
02/2014 – 10/2014	Visiting researcher School of Physics and Astronomy, University of Nottingham, UK
01/2011 – 01/2014	Ph.D. Student in Physics , cotutorship: University of L'Aquila (Italy) & Université Paris Diderot (France) IDAPP program (International Doctorate on AstroParticle Physics) INFN – LNGS Theory group & LPT, Orsay Thesis: Massive Gravity
07/2010	M.Sc. in Physics , University of L'Aquila, Italy. 110/110 <i>cum laude</i>

RESEARCH INTERESTS

Gravity & Cosmology

LIST OF PUBLICATIONS

Authors are always listed in alphabetical order, except in [14,23,24,26,27].

- [27] **No evidence of kinetic screening in simulations of merging binary neutron stars beyond general relativity**
M. Bezares, R. Aguilera-Miret, L. ter Haar, M. C., C. Palenzuela and E. Barausse
Phys. Rev. Lett. **128**, no.9, 091103 (2022) [[arXiv:2107.05648](#)] [[INSPIRE](#)]
- [26] **Kinetic screening in non-linear stellar oscillations and gravitational collapse**
M. Bezares, L. ter Haar, M. C., E. Barausse and C. Palenzuela
Phys. Rev. D **104**, no.4, 044022 (2021) [[arXiv:2105.13992](#)] [[INSPIRE](#)]
- [25] **Degenerate Horava gravity**
E. Barausse, M. C., S. Liberati and L. ter Haar
Class. Quant. Grav. **38**, no. 10, 105007 (2021) [[arXiv:2101.00641](#)] [[INSPIRE](#)]
- [24] **Dynamics of screening in modified gravity**
L. ter Haar, M. Bezares, M. C., E. Barausse and C. Palenzuela
Phys. Rev. Lett. **126**, no. 9, 091102 (2021) [[arXiv:2009.03354](#)] [[INSPIRE](#)]
- [23] **K-dynamics: well-posed 1+1 evolutions in K-essence**
M. Bezares, M. C., C. Palenzuela and E. Barausse
JCAP **2103**, 072 (2021) [[arXiv:2008.07546](#)] [[INSPIRE](#)]
- [22] **Consistency relations for large-scale structure in modified gravity and the matter bi-spectrum**
M. C., M. Lewandowski and F. Vernizzi
Phys. Rev. D **101**, no. 12, 123501 (2020) [[arXiv:1909.07366](#)] [[INSPIRE](#)]
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C. Charmousis, M. C., D. Langlois and K. Noui
Class. Quant. Grav. **36**, no. 23, 235008 (2019) [[arXiv:1907.02924](#)] [[INSPIRE](#)]
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21 authors on behalf of the LISA Cosmology Working Group
JCAP **1907**, no. 07, 024 (2019) [[arXiv:1906.01593](#)] [[INSPIRE](#)]
- [19] **Vainshtein regime in Scalar-Tensor gravity: constraints on DHOST theories**
M. C., M. Lewandowski and F. Vernizzi
Phys. Rev. D **100**, no. 2, 024025 (2019) [[arXiv:1903.11591](#)] [[INSPIRE](#)]
- [18] **Rotating Black Holes in Higher Order Gravity**
C. Charmousis, M. C., R. Gregory and N. Stergioulas
Phys. Rev. D **100**, no. 8, 084020 (2019) [[arXiv:1903.05519](#)] [[INSPIRE](#)]
- [17] **Cosmological evolution in DHOST theories**
M. C., K. Koyama, D. Langlois, K. Noui and D. A. Steer
JCAP **1901**, no. 01, 030 (2019) [[arXiv:1810.12070](#)] [[INSPIRE](#)]
- [16] **Self-accelerating universe in scalar-tensor theories after GW170817**
M. C. and K. Koyama
Phys. Rev. D **97**, no. 8, 084004 (2018) [[arXiv:1712.06556](#)] [[INSPIRE](#)]
- [15] **Vainshtein mechanism after GW170817**
M. C. and K. Koyama
Phys. Rev. D **97**, no. 2, 021301 (2018) [[arXiv:1711.06661](#)] [[INSPIRE](#)]
- [14] **Beyond Lovelock gravity: Higher derivative metric theories**
M. C., K. Noui, C. Charmousis and D. Langlois
Phys. Rev. D **97**, no. 4, 044034 (2018) [[arXiv:1710.04531](#)] [[INSPIRE](#)]

- [13] **Higher Derivative Field Theories: Degeneracy Conditions and Classes**
M. C., R. Klein and D. Roest
JHEP **1706**, 124 (2017) [[arXiv:1703.01623](#)] [[INSPIRE](#)]
- [12] **Degenerate higher order scalar-tensor theories beyond Horndeski up to cubic order**
J. Ben Achour, M. C., K. Koyama, D. Langlois, K. Noui and G. Tasinato
JHEP **1612**, 100 (2016) [[arXiv:1608.08135](#)] [[INSPIRE](#)]
- [11] **Extended Scalar-Tensor Theories of Gravity**
M. C., K. Koyama and G. Tasinato
JCAP **1604**, no. 04, 044 (2016) [[arXiv:1602.03119](#)] [[INSPIRE](#)]
- [10] **Horndeski: beyond, or not beyond?**
M. C., M. Hull, K. Koyama and G. Tasinato
JCAP **1603**, no. 03, 038 (2016) [[arXiv:1601.04658](#)] [[INSPIRE](#)]
- [9] **New Branches of Massive Gravity**
D. Comelli, M. C., K. Koyama, L. Pilo and G. Tasinato
Phys. Rev. D **91**, no. 12, 121502 (2015) [[arXiv:1505.00632](#)] [[INSPIRE](#)]
- [8] **Cosmology of bigravity with doubly coupled matter**
D. Comelli, M. C., K. Koyama, L. Pilo and G. Tasinato
JCAP **1504**, 026 (2015) [[arXiv:1501.00864](#)] [[INSPIRE](#)]
- [7] **FRW Cosmological Perturbations in Massive Bigravity**
D. Comelli, M. C. and L. Pilo
Phys. Rev. D **90**, 084003 (2014) [[arXiv:1403.5679](#)] [[INSPIRE](#)]
- [6] **Restoring General Relativity in massive bigravity theory**
E. Babichev and M.C.
Phys. Rev. D **88**, 084002 (2013) [[arXiv:1307.3640](#)] [[INSPIRE](#)]
- [5] **Degrees of Freedom in Massive Gravity**
D. Comelli, M. C., F. Nesti and L. Pilo
Phys. Rev. D **86**, 101502(R) (2012) [[arXiv:1204.1027](#)] [[INSPIRE](#)]
- [4] **Perturbations in Massive Gravity Cosmology**
D. Comelli, M. C. and L. Pilo
JHEP **06** (2012) 085 [[arXiv:1202.1986](#)] [[INSPIRE](#)]
- [3] **FRW cosmology in ghost free massive gravity from bigravity**
D. Comelli, M. C., F. Nesti and L. Pilo
JHEP **03** (2012) 067 [[arXiv:1111.1983](#)] [[INSPIRE](#)]
- [2] **Spherically Symmetric Solutions in Ghost-Free Massive Gravity**
D. Comelli, M. C., F. Nesti and L. Pilo
Phys. Rev. D **85** (2012) 024044 [[arXiv:1110.4967](#)] [[INSPIRE](#)]
- [1] **Finite Energy for a Gravitational Potential Falling Slower than $1/r$**
D. Comelli, M. C., F. Nesti and L. Pilo
Phys. Rev. D **84** (2011) 104026 [[arXiv:1105.3010](#)] [[INSPIRE](#)]

WHITE PAPERS:

- [1] **Cosmology with the Laser Interferometer Space Antenna**
LISA Cosmology Working Group
[[arXiv:2204.05434](#)] [[INSPIRE](#)]

PROCEEDINGS:

- [1] **On the Cosmology of Massive Bigravity**
M. C., D. Comelli and L. Pilo
Nuovo Cim. C **38**, no. 1, 30 (2015) [[INSPIRE](#)]

VISITS & SEMINARS

Several periods spent for collaboration at:

- INFN Ferrara, Italy
- Laboratoire de Physique Théorique d'Orsay, France
- School of Physics and Astronomy, University of Nottingham, UK
- APC – AstroParticule et Cosmologie, Paris, France
- CERN – Theoretical Physics Department, Geneva, Switzerland

INVITED SEMINARS:

- Institute of Cosmology and Gravitation (ICG), University of Portsmouth, UK
- Department of Physics, Swansea University, UK
- Astrophysics, University of Oxford, UK
- Van Swinderen Institute for Particle Physics and Gravity, University of Groningen, The Netherlands
- Institut de Physique Théorique, CEA Saclay, France
- Département d'Astrophysique, CEA Saclay, France
- Institut d'Astrophysique de Paris, France
- SISSA, Trieste, Italy
- Institute for Fundamental Physics of the Universe (IFPU), Trieste, Italy
- Département de Physique Théorique, Université de Genève, Switzerland
- Central European Institute for Cosmology and Fundamental Physics (CEICO), Institute of Physics, Czech Academy of Sciences, Prague (CZ)
- Astrophysics, University of Cambridge, UK

CONFERENCES AND WORKSHOPS

- [Current challenges in gravitational physics](#) – Online, 21-28 April 2021
Organiser
- [30th Texas Symposium on Relativistic Astrophysics](#) – Portsmouth (UK), 15-20 December 2019
Contributed talk
- [Black Holes and Neutron Stars in Modified Gravity](#) – Meudon (France), 18-20 November 2019
Invited speaker
- Workshop: [Dark Energy Theories](#) – IHP, Paris (France), 19 November 2019
Invited speaker
- [7th LISA Cosmology Working Group Workshop](#) – Padova (Italy), 23-27 September 2019
Contributed talk
- [GR 22 & AMALDI 13](#) – Valencia (Spain), 7-12 July 2019
2 contributed talks
- [Fundamental Physics with LISA](#) – GGI, Florence (Italy), 12-14 November 2018
- Workshop: [Modern Aspects of Gravity and Cosmology](#) – LPT, Orsay (France), 3-4 October 2018
Organiser
- [Gravity and Cosmology 2018](#) – YITP Kyoto (Japan), 19 February - 2 March 2018
Contributed talk

- [Dark Energy and Modified-Gravity cosmologies: DARKMOD](#)
Saclay (France), 25 September - 6 October 2017
Invited speaker
- 9th Aegean Summer School “[Einstein’s theory of gravity and its modifications: from theory to observations](#)” – Sifnos (Greece), 18-23 September 2017
Invited speaker
- [COSMO 2017 @ APC Paris](#) (France), 28 August - 1 September 2017
Contributed talk
- UK Cosmology meeting – Portsmouth, 5 April 2017
Organiser
- UK Cosmology meeting – Nottingham, 15 December 2016
Contributed talk
- Workshop: Modified Gravity – LMPT, Tours (France), 23-24 November 2016
Invited speaker
- Theoretical Cosmology in the Era of Large Surveys – GGI, Florence (Italy), 2-6 May 2016
Contributed talk
- Workshop: Modern Aspects of Gravity and Cosmology
LPT, Orsay (France), 23-24 November 2015
Invited speaker
- ICTP Advanced School on Cosmology – Trieste (Italy), 18-29 May 2015
Contributed talk
- IFAE 2014 - 26th Conference on High Energy Physics – L’Aquila (Italy), 9-11 April 2014
Invited speaker
- 7th Aegean Summer School “[Beyond Einstein’s theory of gravity](#)”
Paros (Greece), 23-28 September 2013
Contributed talk
- [COSMO 2013 @ DAMTP Cambridge](#) (UK), 2-6 September 2013
Contributed talk
- [Tales of Lambda](#) – Nottingham (UK), 1-5 July 2013
Contributed talk
- 2D-IDAPP Meeting @ Ferrara (Italy), 29-31 October 2012
Contributed talk
- ISAPP 2012 “[CMB and High Energy Physics](#)” – La Palma (Spain), 16-24 July 2012
- [Cortona 2012](#) “Convegno di Fisica Teorica” (Italy), 30 May - 1 June 2012
Contributed talk
- ISAPP 2011 “[The dark side of the Universe](#)” – Heidelberg (Germany), 8-15 July 2011
- 2D-IDAPP Meeting @ APC Paris (France), 20-22 June 2011
Contributed talk

MISCELLANEA

◇ TEACHING:

General Relativity, Lectures for PhD students, University of Portsmouth – 2015/2016

◇ FUNDINGS:

- Horizon Europe – Marie Skłodowska-Curie Actions, Global Fellowship 2021 (265 K€)

- “[INFN Fellini Fellowship](#)” (Marie Skłodowska-Curie Actions, Cofund Programme) – Declined
- “[Enhanced Eurotalents](#)” (Marie Skłodowska-Curie Actions, Cofund Programme) – 10/2017 to 12/2018
- Fellowship from [Fondazione Angelo Della Riccia](#) – 02/2014 to 10/2014
- ◊ JOURNAL REFEREE:

Physical Review D, Physical Review Letters, Journal of High Energy Physics (JHEP), Journal of Cosmology and Astroparticle Physics (JCAP), Physics Letters B, European Physical Journal C
- ◊ MAJOR COLLABORATIONS:

LISA Consortium: Cosmology Working Group, Fundamental Physics Working Group, LISA Data Challenge Working Group
- ◊ HABILITATIONS:

Italy: Associate professor in theoretical physics, Associate professor in astrophysics

Trieste, April 15, 2022

OMISSIS

Curriculum Vitae - Pietro Donà

email: OMISSIS

ORCID:

Inspire HEP: P.Dona.1

SCIENTIFIC INTERESTS

General Relativity, Quantum Gravity, Loop Quantum Gravity, Asymptotic Safety, Renormalization Group

WORK EXPERIENCE

- 07/2019 → 07/2021 Postdoctoral Research Fellow
Centre de Physique Theorique,
Case 907, Luminy, Marseille, France
Loop Quantum Gravity, Spin Foam, Numerical methods for Loop Quantum Gravity
co-tutoring of two PhD students and a Master student.
- 09/2017 → 06/2019 Postdoctoral Research Fellow
The Pennsylvania State University,
University Park, PA 16802, USA
Loop Quantum Gravity, Spin Foam, Entanglement Entropy, Information Theory
organization of the group seminars
- 07/2016 → 07/2017 Postdoctoral Research Fellow
Centre de Physique Theorique,
Case 907, Luminy, Marseille, France
Loop Quantum Gravity, Spin Foam, Numerical methods for Loop Quantum Gravity
co-tutoring of two Master students.
- 12/2014 → 08/2016 Postdoctoral Research Fellow
Fudan University,
220 Handan Road, Shanghai 200433, China
Cosmology, Non-Local theories of gravity, Functional Renormalization Group, Asymptotic Safety

EDUCATION

- 10/2010 → 09/2014 Ph.D. in Theoretical Particle Physics
SISSA- Scuola Internazionale Superiore di Studi Avanzati,
via Bonomea, 265, 34136 Trieste, Italy
Thesis “Matter fields in Asymptotic Safety”, advisor: Roberto Percacci
- 09/2008 → 09/2010 Master in Physics - 110/110 with Honors
Università di Pisa,
Lungarno Antonio Pacinotti, 43, 56126 Pisa, Italy
Thesis “Polyhedra in Loop Quantum Gravity”, advisors: Pietro Menotti and Simone Speziale
- 09/2008 → 09/2010 Allievo ordinario classe di Scienze
Scuola Normale Superiore di Pisa,
Piazza dei Cavalieri, 7, 56126 Pisa, Italy
- 09/2005 → 07/2008 Bachelor in Physics - 110/110 with Honors
Università di Pisa,
Lungarno Antonio Pacinotti, 43, 56126 Pisa, Italy
Thesis “Lie Algebras in Particle Physics”, advisor: Damiano Anselmi

QUALIFICATIONS AND AWARDS

Italian Abilitazione scientifica nazionale II Fascia

SSC 02/A2 - Sixth term of the 2018 call – validity 14/04/2021 to 14/04/2030

French Qualification Maître de conférences

Class of Constituants élémentaires – 29 – validity 02/02/2018 - 31/12/2022

IGC Post-Doctoral Scholar award

Penn State University for the academic years 2017/2018 and 2018/2019

TEACHING AND MENTORING

Summer 2021	Organizer and teacher at the LQG Online Summer School 7-25/7/2021. I was the instructor for the course “Numerical Methods in LQG” (teaching load: 2 hours). The school had 350 registered attendants. Recording and details available https://sites.google.com/view/lqgonlinesummerschool
Winter 2020	integration to the course of “Quantum gravity” (teaching load 8 hours) of Prof Carlo Rovelli at the CPT, Marseille, France. The course was addressed to Master and Ph.D. students.
Summer 2019	Invited lecturer for “Numerical methods for Loop Quantum Gravity” (teaching load: 6 hours). at the Bard Summer School on Quantum Gravity, (Bard College, NY, USA) 17-21/6/2019
Spring 2016	co-instructor with Prof. Antonino Marciano for the course of “Gauge Field Theory” (teaching load: 15 hours plus office hours) at Fudan University, Shanghai, China. The course was addressed to Master and Ph.D. students.
Autumn 2015	co-instructor with Prof. Antonino Marciano for the course of “Quantum Field Theory” (teaching load: 12 hours plus office hours) at Fudan University, Shanghai, China. The course was addressed to Bachelor, Master and Ph.D. students.
Spring 2015	co-instructor with Prof. Antonino Marciano for the course of “Advanced topics on Quantum Field Theory” (teaching load: 6 hours plus office hours) at Fudan University, Shanghai, China. The course was addressed to Master and Ph.D. students.
co-mentored	Giorgio Sarno for his master thesis during Autumn 2016 and Winter 2017. Thesis title “Simplicial and Generalized Spinfoams in Loop Quantum Gravity: Analytical and Numerical Results” defended in April 2017 at Università degli Studi di Torino - 110L/110
mentored	Alessandro Nicotra for his master thesis during Autumn 2020 and Winter 2021 Thesis title "Wick rotation of the EPRL spin foam models" defended in February 2021 at Università degli Studi di Bologna - 110L/110
mentoring	Alessandro Pisana for his master thesis during Winter 2022 and Spring 2022 Thesis title "Tensor network techniques in Loop Quantum Gravity" due in July 2022 at Università degli Studi di Padova
co-mentored	Dr. Giorgio Sarno for his Ph.D. work from September 2017 to September 2020 Thesis title "A numerical approach to spin foam models of quantum gravity" defended in September 2020 at the Centre de Physique Théorique in Marseille

CONFERENCES AND SEMINARS

June 18-22, 2022	LOOPS 2022, Ecole Normale Supérieure de Lyon, France Invited plenary speaker. “Numerical evaluation of spin foam transition amplitudes”
June 11-15, 2022	Loop Quantum Gravity Summer School, Centre de Physique Théorique, Marseille, France Invited lecturer for the course of “Spin Foam calculation with a computer”
June 7-25, 2021	Loop Quantum Gravity Online Summer School, Organizer and lecturer for the course of “Numerical methods in LQG”
January 13-17, 2020	The Quantum Information Structure of Spacetime, Hong Kong University, Hong Kong Invited speaker “Quantum Information of Loop Quantum Gravity States”
June 24-27, 2019	IGC@25, PennState University, State College, PA, USA
June 17-21, 2019	LOOPS 2019, PennState University, State College, PA, USA Invited plenary speaker “Numerical Study of Spin Foam Theories”
June 9-16, 2019	The Bard Summer School on Quantum Gravity, Bard College, NY, USA Invited lecturer “Numerical Methods in LQG”
April 26, 2018,	Perimeter Institute for Theoretical Physics, Waterloo, Canada Invited seminar “Spin Foams: a numerical revolution”
March 5-9, 2018	Quantum Gravity on the Computer, Nordita Stockholm, Sweden
November 3-5, 2017	MAS-APS, Newark, NJ, USA - American Physical Society Speaker “Quantum Gravity made from quantum polyhedra”
October 10, 2017	International Loop Quantum Gravity Seminar Seminar “SU(2) graph invariants, Regge actions and polytopes”
July 3-7, 2017,	LOOPS 2017, Warsaw, Poland - University of Warsaw Speaker “Computing Lorentzian Spin Foam Amplitudes: Overview”
January 16 th , 2017	Laboratoire de Physique Théorique d’Orsay, Paris Seminar “Cosmological applications of coherent states”
August 10-15, 2016	21st International Conference on General Relativity and Gravitation, Columbia University, New York, USA
April 14-15, 2016	Fudan-Tokyo-Yonsei Workshop on Particle and Nuclear Physics, Fudan University, Shanghai, China Speaker “Non-Perturbative Yang-Mills Condensate as Dark Energy”
December 14-18, 2015	2nd LeCosPA International Symposium “Everything about Gravity”, National Taiwan University, Taipei, Taiwan Speaker “Asymptotic safety in an interacting system of gravity and matter”
September 28-29, 2015	Early Universe Workshop, Tangzhongying National Lab, Nanjing, China Speaker “Non-Perturbative Yang-Mills Condensate as Dark Energy”
July 12-18, 2015	14th Marcel Grossmann Meeting, University of Rome “La Sapienza”, Rome, Italy
July 28-30 2015	LOOPS 2015 Friedrich-Alexander University, Erlangen, Germany
December 13, 2014	Beijing Normal University Seminar “Matter Matters in Asymptotically Safe Quantum Gravity”
May 28-30 2014	1 st FLAG meeting, “The Quantum and Gravity”, Bologna, Italy

April 28, 2014	Primordial Universe and Gravity Discussions at Institute for Gravitation and Cosmos Seminar “Matter Matters in Asymptotically Safe Quantum Gravity”
April 22-25 2014	Renormalization Group Approaches to Quantum Gravity at Perimeter Institute for Theoretical Physics, Waterloo, Canada
January 21, 2014	International Loop Quantum Gravity Seminar Seminar “Matter Matters in Asymptotically Safe Quantum Gravity”
December 2 2013	Asymptotic Safety online seminar Seminar “Matter Matters in Asymptotically Safe Quantum Gravity”
November 7 2013	Perimeter Institute for Theoretical Physics, Waterloo, Canada Seminar “Matter Matters in Asymptotically Safe Quantum Gravity”
July 22-26, 2013	LOOPS 2013, Perimeter Institute for Theoretical Physics, Waterloo, ON, Canada
May 18, 2013	Centre de Physique Theorique, Marseille, France Seminar “Fermions and Tetrads in Asymptotic Safety”
October 15, 2012	Asymptotic Safety web seminars Seminar “Fermions and Tetrads in Asymptotic Safety”
September 2-7, 2012	ERG2012, Centre Paul Langevin, Aussois, France

PUBLICATIONS SUMMARY

Full list of publications: <https://inspirehep.net/authors/1072680>

Number of publications: 25 (3 papers with more than 100 citations and 35 avg)

Number of citations on Inspire: ~1000

19/04/2022
Pietro Dona

CURRICULUM VITAE

- *Name:* Giuseppe Fanizza
- *Birthplace and Birthdate:* OMISSIS
- *Present Positions:* Junior Researcher at the University of Lisbon - Portugal
- *Nationality:* Italian
- *Affiliation:* Instituto de Astrofísica e Ciências do Espaço, Faculdade de Ciências da Universidade de Lisboa
- *INSPIRE WEBPAGE:* <http://inspirehep.net/search?p=exactauthor%3AG.Fanizza.1&sf=earliestdate>
- *ArXiv Webpage:* https://arxiv.org/search/?query=fanizza%2Cg&searchtype=all&abstracts=hide&order=-announced_date_first&size=50
- *OrcID:* 0000-0001-5173-3800
- *Web of Science ResearcherID:* Q-9196-2019

INFORMATIC KNOWLEDGES

Unix OS, MS-Dos/Windows OS, C, C++, IC3 2005 Plus, Wolfram Mathematica, Python

LANGUAGES

- Italian (mother tongue)
- English (fluent)
- German (scholastic)
- French (scholastic)

EDUCATION

- 2006-2009 Bachelor's degree studies in Physics at the University of Bari - Italy. Thesis: "The Superconductibility", in the group of Prof. P. Cea. Graduated with marks 110/110 cum laude
- 2009-2011 M. Sc. studies in Physics at the University of Bari - Italy. Research Thesis: "Study of Dark Energy in inhomogeneous and anisotropic models of Universe", in the group of Dr. L. Tedesco. Graduated with marks 110/110 cum laude
- 2012-2014 Ph.D studies in Theoretical Relativistic Cosmology (FIS/02) at the Physics Department of the University of Bari - Italy. Thesis "Impact of inhomogeneities on cosmological observations", in the group of Dr. L. Tedesco. **Graduated on 18th March 2015** with the highest mark (excellent)
- 02-04/2013 3 months at the Department of Theoretical Physics of the University of Geneva - Switzerland as visitor in the group of Prof. R. Durrer

05-07/2013 3 months at College de France in Paris - France as visitor in the group of Prof. G. Veneziano

05-07/2014 3 months at the Department of Theoretical Physics of the University of Geneva - Switzerland as visitor in the group of Prof. R. Durrer

LONG TERM VISITS (LONGER THAN 2 WEEKS)

- 13/03/2022 - 13/04/2022: Department of Physics of the University of Pisa - Italy as Visiting Fellow
- 14/02/2020 - 29/02/2020: CERN, Geneva - Switzerland as Short-Term Visitor of the CERN theory group
- 30/11/2018 - 21/12/2018: CERN, Geneva - Switzerland as Short-Term Visitor of the CERN theory group
- 31/07/2017 - 11/08/2017: Centro de Ciencias de Benasque Pedro Pascual, Benasque - Spain
- 21/03/2016 - 15/04/2016: Galileo Galilei Institute for Theoretical Physics, Florence - Italy
- 01/05/2014 - 31/07/2014: Department of Theoretical Physics of the University of Geneva - Switzerland as visitor in the group of Prof. R. Durrer
- 01/05/2013 - 31/07/2013: College de France in Paris - France as visitor in the group of Prof. G. Veneziano
- 01/02/2013 - 30/04/2013: Department of Theoretical Physics of the University of Geneva - Switzerland as visitor in the group of Prof. R. Durrer
- 16/07/2012 - 27/07/2012: Summer School on Cosmology, Abdus Salam International Centre for Theoretical Physics ICTP, Trieste - Italy

QUALIFICATIONS

- **Habilitated** by the Italian *Abilitazione Scientifica Nazionale* committee as **Associate Professor in Mathematical Physics** (01/A4 - SSD MAT/07) from 09/11/2020 until 09/11/2029

EMPLOYMENT HISTORY

Current position

- 01/10/2019 - : **Junior Researcher** at the University of Lisbon and the Institute of Astrophysics and Space Science (IA), Lisbon - Portugal. Winner of a **6 years long** grant funded by the Fundacao para Ciencia e a Tecnologia (FCT) under the Stimulus of Scientific Employment - Individual Support for the submitted research project “Precision cosmology and CMB experiments: a new window on fundamental physics”.

Previous positions

- 01/09/2021 - 31/12/2021: Corresponding Associate at CERN, Geneva - Switzerland.
- 01/10/2018 - 30/09/2019: post-doc researcher at the Istituto Nazionale di Fisica Nucleare INFN - sezione di Pisa - Italy.
- 16/10/2016 - 30/09/2018: post-doc researcher at the Center for Theoretical Astrophysics and Cosmology, Institute for Computational Science, of the University of Zurich - Switzerland in the group of Prof. Jaiyul Yoo.
- 16/10/2015 - 15/10/2016: post-doc researcher at the Physics Department of the University of Bari - Italy in the group of Prof. M. Gasperini.
- 01/01 - 15/10/2015: post-doc researcher at Department of Theoretical Physics of the University of Geneva - Switzerland in the group of Prof. R. Durrer. Winner of a grant funded by the Angelo Della Riccia foundation, Florence - Italy for the submitted research project “Theoretical aspects of precision cosmology”.

GRANTED RESEARCH PROJECTS AND ACTIVITIES

- 2021 Corresponding Associate at CERN, Geneva - Switzerland . Duration: **4 months** (September-December 2021). Grant: **CHF 16 692,00 ($\approx$ € 16 000,00)**
- 2020 “A SHOT IN THE DARK: new challenges in Cosmology”. Grant funded by the Lorentz center, Leiden - Netherlands for the organization of an international workshop in Leiden. Grant: **€ 6 875,00.**
- 2019 “Precision cosmology and CMB experiments: a new window on fundamental physics”. Grant funded by the Fundacao para Ciencia e a Tecnologia FCT - Portugal under the Stimulus of Scientific Employment - Individual Suppor, grant no. CEECIND/04399/2017/CP1387/CT0026. Duration: **6 years**. Grant: **€ 153 000,00**. The ongoing activity along this research project has produced so far 6 publications on highly rated international journals.
- 2015 “Theoretical aspects of precision cosmology”. Grant funded by the Angelo Della Riccia foundation, Florence - Italy. Duration: **10 months**. Grant: **€ 18 000,00**. The activity along this research project has produced 2 publications on highly rated international journals and put the basis for subsequent work in CMB lensing.

MEMBERSHIPS IN SCIENTIFIC COLLABORATIONS

- since 2022 Fundação para a Ciência e a Tecnologia (FCT) - Beyond Lambda (BeyLa) project ref. number PTDC/FIS-AST/0054/2021
- since 2021 Istituto Italiano di Alta Matematica “Francesco Severi” (INdAM) - Gruppo Nazionale per la Fisica Matematica (GNFM) (National Group for Mathematical Physics)
- since 2019 The European Consortium of AstroParticle Theory (EuCAPT)

2018 - 2019 Istituto Nazionale di Fisica Nucleare (INFN) - Theoretical Astroparticle Physics (TAsP)

2016 - 2018 European Research Council (ERC) - ERC-2015-CoG Grant no. 680886

2015 - 2016 Istituto Nazionale di Fisica Nucleare (INFN) - Theoretical Astroparticle Physics (TAsP)

2015 - 2016 Ministero dell'Istruzione, dell'Università e della Ricerca (MIUR) - Grant no. 2012CPPYP7 (PRIN 2012)

STUDENTS AND POSTDOCS

- 10-12/2021 **PhD student:** Tiziano Schiavone. University of Pisa - Italy. Role: **Supervisor**. Supervision of the PhD student activity during his formation period in foreign institutions as CERN and University of Geneva - Switzerland.
- 15/12/2021 **Master student:** Eliseo Pavone. Thesis “*Shear Viscous Effects on Gravitational Waves Propagation in Λ CDM Model and Beyond*”. Graduated at the University of Bari - Italy with the highest mark (110/100 cum laude). Role: **Supervisor**, in collaboration with Dr. L. Tedesco. Results have been extended and presented in the preprint G. Fanizza, E. Pavone and L. Tedesco, “*Gravitational Wave luminosity distance in viscous cosmological models*”, arXiv:2203.13368 [gr-qc] currently submitted to JCAP.
- 22/01/2021 **Master student:** Vitor Manuel da Fonseca. Thesis “*Testing Dark Energy couplings*”. Graduated at the University of Lisbon - Portugal with the highest mark (20/20). Role: **Referee**.
- 03-08/2020 **Master student:** Lucie Khlat. Thesis “*Gravitational waves into scalar induced tensor perturbations formalism*”. Graduated at Ecole Normale Supérieure de Lyon - France. Role: **Supervisor**, in collaboration with Prof. R. Durrer, University of Geneva - Switzerland.
- 09/12/2019 **Master student:** Gloria Schiaffino. Thesis “*Linear perturbation theory and luminosity distance in the Geodesic Light-Cone coordinates*”. Graduated at the University of Pisa - Italy with mark 106/110. Role: **Supervisor**, in collaboration with Dr. G. Marozzi. Results have been extended and **published** in G. Fanizza, G. Marozzi, M. Medeiros and G. Schiaffino, “*The Cosmological Perturbation Theory on the Geodesic Light-Cone background*”, JCAP **02**, 014 (2021), arXiv:2009.14134 [gr-qc].
- 17/10/2019 **Master student:** Alice Boldrin. Thesis “*CMB lensing in an anisotropic Universe*”. Graduated at the University of Pisa - Italy with mark 100/110. Role: **Supervisor**, in collaboration with Dr. G. Marozzi. Current position: **PhD student** at University of Warsaw - National Center for Nuclear Research (NCBJ), (Poland).
- 19/07/2019 **Master student:** Chiara Animalì. Thesis “*Stochastic background of gravitational waves from amplification of vacuum fluctuations in a bimetric theory of gravity*”. Graduated at the University of Pisa - Italy with mark 110/110. Role: **Referee**.
- 10/12/2018 **Master student:** Marta Monelli. Thesis “*Back-reaction of a cosmological background of gravitational waves*”. Graduated at the University of Pisa - Italy with mark 110/110. Role: **Referee**.
- 13/12/2018 **Master student:** Bartolomeo Fiorini. Thesis “*Local Hubble flow and cosmic variance for next generation Large Scale Structure survey*”. Graduated at the University of Pisa - Italy with mark 110/110. Role: **Supervisor**, in collaboration with Dr. G. Marozzi. Results have been extended and **published** in G. Fanizza, B. Fiorini and G. Marozzi, “*Cosmic variance of H_0 in light of forthcoming high-redshift surveys*”, Phys. Rev. D **104**, no.8,

083506 (2021), arXiv:2102.12419 [astro-ph.CO]. Current position: **PhD student** at University of Portsmouth - Institute for Cosmology and Gravitation (ICG), (UK).

21/07/2016 **Master student**: Nicola Pinto. Thesis “*Effetto di deriva del redshift e geometria FLRW perturbata*” (*Redshift Drift and Cosmological Perturbation Theory*). Graduated at University of Bari - Italy with the highest mark (110/110 cum laude). Role: **Supervisor**, in collaboration with Dr. L. Tedesco.

TEACHING EXPERIENCE

2019 15 hours PhD Course in “*Cosmology and Gamma Ray Astrophysics*”, University of Bari - Italy. **Lecturer** in collaboration with Dr. E. Bissaldi.

2013-2014 6 hours Master Course in “*Theory of Fundamental Interactions - General Relativity*”, University of Bari. Assistant by Prof. M. Gasperini, Department of Physics, University of Bari - Italy

2011-2012 20 hours Undergraduate Course in “*General Physics for Construction Engineering*”, Polytechnic of Bari. Assistant by Prof. G. Maggi, Department of Physics, University of Bari - Italy.

EVALUATION PANEL MEMBERSHIPS

2022 – **Member** of the evaluation panel for the assignment of 1 Research Fellowship for a PhD Student (Ref: IA2022-04-BI) at the Instituto de Astrofísica e Ciências do Espaço - Portugal.

– **Member** of the evaluation panel for the assignment of 1 Research Fellowship for a Master Student (Ref: IA2022-05-BI) at the Instituto de Astrofísica e Ciências do Espaço - Portugal.

2021 **Member** of the evaluation panel for the assignment of 1 PhD Studentship in Astronomy, Astrophysics and Cosmology (Ref: IA2020-09-BID) at the Instituto de Astrofísica e Ciências do Espaço - Portugal.

ORGANIZATION OF CONFERENCES AND SEMINARS

Ongoing

27/06-01/07/22 A SHOT IN THE DARK: new challenges in Cosmology; Lorentz center, Leiden - Netherlands; **Scientific Organizing Committee member**

03/2020-ongoing **Organizer** of the seminars in Cosmology within the semestral scheduling of the Instituto de Astrofísica e Ciências do Espaço, Faculdade de Ciências da Universidade de Lisboa - Portugal

Previous events

- 09-11/09/2020 30th Encontro Nacional de Astronomia e Astrofisica; Porto - Portugal; **Organizing Committee member**
- 01-06/2019 Series of seminars “*Fisica dell’Universo*”; University of Pisa - Italy; **Scientific Organizing Committee member**. Invited speakers: Dr. M. Burgay (06/02/2019) - Prof. R. Durrer (19/02/2019) - Dr. R. Mignani (06/03/2019) - Prof. L. Rezzolla (03/06/2019)
- 05-07/07/2017 Practitioners’ Workshop on Relativistic Effects in Large Scale Structures; University of Zurich - Switzerland; **Scientific Organizing Committee member**
- 10/2016-09/2018 **Organizer** of the seminars in Cosmology within the semestral scheduling of the Institute for Computational Science; University of Zurich - Switzerland
- 13-18/12/2015 28th Texas Symposium on Relativistic Astrophysics; International Conference Centre; Geneva - Switzerland; **Helper**

SCHOOLS, TALKS AND CONFERENCES

- 10/11/2021 CERN, Geneva - Switzerland; **invited talk**: “*Cosmic Variance and Hubble diagram at higher redshifts*”
- 29/10/2021 Department of Theoretical Physics of the University of Geneva - Switzerland; **invited talk**: “*Hubble diagram and precision cosmology*”
- 25-29/07/2021 16th U.S. National Congress on Computational Mechanics; Chicago - United States; **talk**: “*Wave propagation in peridynamics*”
- 05-10/07/2021 16th Marcel Grossmann Meeting; Rome - Italy; **2 talks**: “*Precision Cosmology and Hubble tension in the era of LSS surveys*” and “*Averaging cosmological observables in the LSS surveys*”
- 07/05/2021 Dipartimento di scienze Fisiche e Chimiche, Università dell’Aquila - Italy; **invited talk** (web-seminar): “*Precision cosmology in the era of Large-Scale-Structure surveys*”
- 05-07/05/2021 First EuCAPT Annual Symposium, CERN, Geneva - Switzerland; participant
- 29/03-01/04/21 IberiCOS 2021 - 15th Iberian Cosmology Meeting; Universidade de Coimbra, Coimbra - Portugal; **talk**: “*Hubble constant measurement in light of forthcoming high-redshift surveys*”
- 12/06/2020 Mini-workshop “Impact of relativistic effects on searches for non-Gaussianity with two-point functions”, CERN, Geneva - Switzerland; **invited participant**
- 28/05/2020 Institute for Theoretical Physics (IFT), Universidad Autónoma de Madrid - Spain; **invited talk** (web-seminar): “*Averaging cosmological observables in the LSS surveys*”
- 26/03/2020 CENTRA, Instituto Superior Técnico, Lisbon - Portugal; **invited talk** (web-seminar): “*Higher order statistics in the late-time cosmological observables: from analytical to numerical results*”
- 26/02/2020 CERN, Geneva - Switzerland; **invited talk**: “*Formal aspects of averaging cosmological observables in the LSS surveys*”

- 15-20/12/2019 30th Texas Symposium on Relativistic Astrophysics; University of Portsmouth, Portsmouth - United Kingdom; **talk:** *“Averaging observables in the LSS surveys: a new rigorous approach”*
- 10-11/10/2019 IA-ON6 - Annual meeting of the Institute of Astrophysics, Porto - Portugal; **talk:** *“Averaging observables in the LSS surveys: a new rigorous approach”*
- 29/07-09/08/19 Understanding Cosmological Observations; Centro de Ciencias de Benasque “Pedro Pascual”, Benasque - Spain; participant
- 15-19/07/2019 Inhomogeneous Cosmologies IV; Nicolaus Copernicus University, Torun - Poland; **invited talk:** *“The dynamics of General Relativity in the Geodesic Light-Cone coordinates”*
- 27/06/2019 Dipartimento di Fisica, Università di Padova - Italy; **invited talk:** *“Next-to-leading order lensing corrections to the CMB spectra”*
- 17-19/06/2019 Practitioners’ Workshop on Relativistic Effects in Large Scale Structures; University of Zurich - Switzerland; **invited talk:** *“ H_0 measurement from higher redshift surveys”*
- 30/01/2019 Institute of Astrophysics and Space Science, University of Lisbon - Portugal; **invited talk:** *“Non-linear CMB lensing and next generation experiments”*
- 22/11/2018 Dipartimento di Fisica, Università di Pisa - Italy; **talk:** *“Inhomogeneous cosmology and expansion of the Universe: a fractal exact solution”*
- 17-21/09/2018 Analytics, Inference and Computation in Cosmology - Workshop “Analytical Methods”; Institut “Henri Poincaré”, Paris - France; participant
- 19/04/2018 Dipartimento di Fisica, Università di Pisa - Italy; **invited talk:** *“Observing the light-cone in the era of Large-Scale Structures cosmology: the GLC gauge”*
- 11-13/04/2018 UniVersum; Università di Bologna - Italy; **talk:** *“Non linear effects in the observed redshift: how to obtain gauge invariance for non linear observables”*
- 23/03/2018 Department of Theoretical Physics of the University of Geneva - Switzerland; **invited talk:** *“Non linear effects in the observed redshift: how to obtain gauge invariance for non linear observables”*
- 12-16/03/2018 Probing fundamental physics with CMB spectral distortions; CERN, Geneva - Switzerland; participant
- 05-06/02/2018 Swiss Cosmology Days 2018; CERN, Geneva - Switzerland; participant
- 06/12/2017 École Normale Supérieure de Paris - France; **interview for Junior Researcher Chair** at the Department of Physics: *“Non-linear Relativistic Effects in the era of Precision Cosmology”*
- 16/11/2017 University of Jyväskylä - Finland; **invited talk:** *“Non-linear CMB lensing and next generation experiments”*
- 15/11/2017 Helsinki Institute of Physics, University of Helsinki - Finland; **invited talk:** *“Non-linear CMB lensing and next generation experiments”*
- 31/07-11/08/17 Understanding Cosmological Observations; Centro de Ciencias de Benasque “Pedro Pascual”, Benasque - Spain; participant
- 09-15/07/2017 13rd Rencontre du Vietnam: Cosmology; ICISE, Quy Nhon - Vietnam; **invited plenary talk:** *“CMB-lensing beyond the leading order: temperature and polarization anisotropies”*

- 05-07/07/2017 Practitioners' Workshop on Relativistic Effects in Large Scale Structures; University of Zurich - Switzerland; **talk:** *"Coordinates Lapses and perturbed redshift at second order"*
- 03-04/04/2017 UniVersum; Università di Torino - Italy; **invited talk:** *"CMB lensing beyond the leading order"*
- 20/03/2017 Institut d'Astrophysique de Paris - France; **invited talk:** *"CMB spectra and weak gravitational lensing: are next-to-leading order corrections relevant for future observations?"*
- 13-15/02/2017 Workshop on GR effects in Cosmological Surveys; University of Cape Town - South Africa; **invited talk:** *"Post-Born and LSS lensing corrections to CMB spectra"*
- 6-7/02/2017 Swiss Cosmology Days 2017; University of Basel - Switzerland; **talk:** *"Next-to leading order corrections to CMB spectra"*
- 10/11/2016 Center for Theoretical Astrophysics and Cosmology, Institute for Computational Science, University of Zurich - Switzerland; **invited talk:** *"Lensing and CMB: next-to-leading order corrections beyond the Born approximation"*
- 21/03-17/04/16 Workshop on Theoretical Cosmology in the Era of Large Surveys; Galileo Galilei Institute for Theoretical Physics; Florence - Italy; **talk:** *"Ultra-relativistic particles in an inhomogeneous universe: can we use them for precision cosmology?"*
- 13-18/12/2015 28th Texas Symposium on Relativistic Astrophysics; International Conference Centre, Geneva - Switzerland; **talk:** *"High-precision cosmology and inhomogeneities: exact results in the geodesic light-cone gauge"*
- 25/11/2015 Department of Theoretical Physics of the University of Heidelberg - Germany; **invited talk:** *"High-precision cosmology and inhomogeneities: exact results in the geodesic light-cone gauge"*
- 7-11/09/2015 19th annual International Conference on Particle Physics and Cosmology; University of Warsaw - Poland; **talk:** *"CMB lensing and deflection angles in high precision cosmology"*
- 5-6/02/2015 Swiss Cosmology Days 2015; University of Geneva - Switzerland; participant
- 6-16/01/2015 Understanding the Early Universe; CERN, Geneva - Switzerland; participant
- 23-27/06/2014 20th International Symposium on Particles, Strings and Cosmology, PASCOS 2014; University of Warsaw - Poland; **talk:** *"Jacobi map and physical observables: an exact solution in the GLC gauge"*
- 06/06/2014 Department of Theoretical Physics of the University of Geneva - Switzerland; **invited talk:** *"Jacobi map and physical observables: an exact solution in the GLC gauge"*
- 14-17/10/2013 IX International Workshop; Dark Side of the Universe; SISSA, Trieste - Italy; **talk:** *"An exact Jacobi map in the Geodetic Light-Cone Gauge"*
- 28/08-05/09/13 2nd International Conference on New Frontiers in Physics; Kolymbari - Greece; **talk:** *"An exact Jacobi map in the Geodetic Light-Cone Gauge"*
- 15/02/2013 Swiss Cosmology Day; University of Bern, Bern - Switzerland; participant
- 30/11-02/12/12 9th Vienna Central European Seminar on Particle Physics and Quantum Field Theory; Dark Matter, Dark Energy, Black Holes and Quantum Aspect of the Universe; Faculty of Physics - University of Vienna, Vienna - Austria; **poster:** *"Study of Dark Energy in anisotropic and inhomogeneous models of the Universe"*

29-31/10/2012 5th Strings, Cosmology and Gravity Student Conference 2012; Institut Henri Poincaré, Paris - France; participant

16-27/07/2012 Summer School on Cosmology; Abdus Salam International Center for Theoretical Physics, Trieste - Italy; participant

OTHER ACTIVITIES

Referee for international journals as:

- Physical Review Letters (IF: 9.161)
- Astronomy and Astrophysics (IF: 5.636)
- Physical Review D (IF: 5.296)
- Journal of Cosmology and Astroparticle Physics (IF: 5.210)
- European Physical Journal C (IF: 4.843)
- Scientific Reports (IF: 4.379)
- Classical and Quantum Gravity (IF: 3.487)
- European Physical Journal Plus (IF: 3.228)

Press Interviews:

- “*Il ricercatore che raduna gli esploratori dell’Universo*”, interview with E. Pagani, **La Stampa** (italian newspaper), 30/03/17

PUBLICATIONS - REFEREED PAPERS, PROCEEDINGS AND PREPRINTS

1. L. Khlat, R. Durrer and **G. Fanizza**, “*Gravitational Waves from density perturbations in the late Universe*”, in preparation.
2. E. Di Dio, **G. Fanizza** and T. Schiavone, “*Skewness and kurtosis of the distance-redshift relation in the concordance model*”, in preparation.
3. **G. Fanizza**, G. Marozzi and M. Medeiros, “ *δN formalism and GLC gauge*”, in preparation.
4. **G. Fanizza**, E. Pavone and L. Tedesco, “*Gravitational Wave luminosity distance in viscous cosmological models*”, arXiv:2203.13368 [gr-qc], submitted to JCAP.
5. **G. Fanizza**, E. Di Dio, R. Durrer and G. Marozzi, “*The gauge invariant cosmological Jacobi map from weak lensing at leading order*”, arXiv:2201.11552 [astro-ph.CO], submitted to JCAP.

6. **G. Fanizza**, “*Precision Cosmology and Hubble tension in the era of LSS surveys*”, Proceeding for 16th Marcel Grossmann meeting, arXiv:2110.15272 [astro-ph.CO].
7. G. M. Coclite, S. Dipierro, **G. Fanizza**, F. Maddalena, M. Romano and E. Valdinoci, “*Qualitative aspects in nonlocal dynamics*”, arXiv:2106.13596 [nlin.PS], published in J. Perydin. Nonlocal model.
8. **G. Fanizza**, M. Gasperini, E. Pavone and L. Tedesco, “*Linearized propagation equations for metric fluctuations in a general (non-vacuum) background geometry*”, JCAP **07**, 021 (2021), arXiv:2105.13041 [gr-qc].
9. G. M. Coclite, S. Dipierro, **G. Fanizza**, F. Maddalena and E. Valdinoci, “*Dispersive effects in a peridynamic model*”, arXiv:2105.01558 [math.AP], submitted to Nonlinearity.
10. **G. Fanizza**, B. Fiorini and G. Marozzi, “*Cosmic variance of H_0 in light of forthcoming high-redshift surveys*”, Phys. Rev. D **104**, no.8, 083506 (2021), arXiv:2102.12419 [astro-ph.CO].
11. G. M. Coclite, **G. Fanizza** and F. Maddalena, “*Regularity and energy transfer for a nonlinear beam equation*”, Applied Mathematics Letters **115**, 106959 (2021), arXiv:2011.05246 [math.AP].
12. E. Mitsou, **G. Fanizza**, N. Grimm and J. Yoo, “*Cutting out the cosmological middle man: General Relativity in the light-cone coordinates*”, Class. Quant. Grav. **38** (2021), 055011, arXiv:2009.14687 [gr-qc].
13. **G. Fanizza**, G. Marozzi, M. Medeiros and G. Schiaffino, “*The Cosmological Perturbation Theory on the Geodesic Light-Cone background*”, JCAP **02**, 014 (2021), arXiv:2009.14134 [gr-qc].
14. **G. Fanizza**, G. Franchini, M. Gasperini and L. Tedesco, “*Comparing the luminosity distance for gravitational waves and electromagnetic signals in a simple model of quadratic gravity*”, Gen. Rel. Grav. **52** (2020) no.11, 111, arXiv:2010.06569 [gr-qc].
15. **G. Fanizza**, M. Gasperini, G. Marozzi and G. Veneziano, “*Generalized covariant prescriptions for averaging cosmological observables*”, JCAP **2002**, 017 (2020), arXiv:1911.09469 [gr-qc].
16. E. Di Dio, R. Durrer, **G. Fanizza** and G. Marozzi, “*Rotation of the CMB polarisation by foreground lensing*”, Phys. Rev. D **100**, 043508 (2019), arXiv:1905.12573 [astro-ph.CO].
17. **G. Fanizza**, M. Gasperini, G. Marozzi and G. Veneziano, “*Observation angles, Fermi coordinates, and the Geodesic-Light-Cone gauge*”, JCAP **1901**, no. 01, 004 (2019), arXiv:1812.03671 [astro-ph.CO].
18. L. Cosmai, **G. Fanizza**, F. Sylos Labini, L. Pietronero and L. Tedesco, “*Fractal universe and cosmic acceleration in a Lemaître-Tolman-Bondi scenario*”, Class. Quant. Grav. **36**, no. 4, 045007 (2019), arXiv:1810.06318 [astro-ph.CO].
19. **G. Fanizza**, “*Relations between physical observables: what is better?*”, arXiv:1806.08611 [astro-ph.CO].
20. **G. Fanizza**, J. Yoo and S. G. Biern, “*Non-linear general relativistic effects in the observed redshift*”, JCAP **1809**, 037 (2018), arXiv:1805.05959 [gr-qc].
21. E. Mitsou, F. Scaccabarozzi and **G. Fanizza**, “*Observed Angles and Geodesic Light-Cone Coordinates*”, Class. Quant. Grav. **35**, no. 10, 107002 (2018), arXiv:1712.05675 [gr-qc].
22. G. Marozzi, **G. Fanizza**, E. Di Dio and R. Durrer, “*Impact of next-to-leading order contributions to CMB lensing*”, Phys. Rev. Lett. **118**, no. 21, 211301 (2017), arXiv:1612.07650 [astro-ph.CO].

23. G. Marozzi, **G. Fanizza**, E. Di Dio and R. Durrer, “*CMB-lensing beyond the leading order: temperature and polarization anisotropies*”, Phys. Rev. D **98**, 023535 (2018), arXiv:1612.07263 [astro-ph.CO].
24. G. Marozzi, **G. Fanizza**, E. Di Dio and R. Durrer, “*CMB-lensing beyond the Born approximation*”, JCAP **1609**, 028 (2016), arXiv:1605.08761 [astro-ph.CO].
25. P. Fleury, F. Nugier and **G. Fanizza**, “*Geodesic-light-cone coordinates and the Bianchi I spacetime*”, JCAP **1606**, no. 06, 008 (2016), arXiv:1602.04461 [gr-qc].
26. **G. Fanizza**, M. Gasperini, G. Marozzi and G. Veneziano, “*Time of flight of ultra-relativistic particles in a realistic Universe: a viable tool for fundamental physics?*”, Phys. Lett. B **757**, 505 (2016), arXiv:1512.08489 [astro-ph.CO].
27. **G. Fanizza** and L. Tedesco, “*Anisotropic expansion of the Universe and generation of quantum interference in light propagation*”, Int.J.Theor.Phys. **55** (2016) no.4, 2020-2025, arXiv:1510.02352 [gr-qc].
28. L. Cosmai, **G. Fanizza** and L. Tedesco, “*Cosmic acceleration and $f(R)$ theory: perturbed solution in a matter FLRW model*”, Int. J. Theor. Phys. **55**, no. 2, 754 (2016), arXiv:1311.7281 [astro-ph.CO].
29. **G. Fanizza**, M. Gasperini, G. Marozzi and G. Veneziano, “*A new approach to the propagation of light-like signals in perturbed cosmological backgrounds*”, JCAP **1508**, no. 08, 020 (2015), arXiv:1506.02003 [astro-ph.CO].
30. **G. Fanizza** and F. Nugier, “*Lensing in the geodesic light-cone coordinates and its (exact) illustration to an off-center observer in Lemaître-Tolman-Bondi models*”, JCAP **1502**, no. 02, 002 (2015), arXiv:1408.1604 [astro-ph.CO].
31. **G. Fanizza** and L. Tedesco, “*Inhomogeneous and anisotropic Universe and apparent acceleration*”, Phys. Rev. D **91**, 023006 (2015), arXiv:1412.8371 [gr-qc].
32. **G. Fanizza** and L. Tedesco, “*Electrodynamics in an LTB scenario*”, Eur. Phys. J. C **74** (2014) 2786, arXiv:1402.3486 [astro-ph.CO].
33. **G. Fanizza**, “*Jacobi map and geodesic light-cone gauge: an exact solution*”, EPJ Web Conf. **71** (2014) 00048, Proceeding for 2nd International Conference on New Frontiers in Physics.
34. **G. Fanizza**, M. Gasperini, G. Marozzi and G. Veneziano, “*An exact Jacobi map in the geodesic light-cone gauge*”, JCAP 1311 (2013) **019**, arXiv:1308.4935 [astro-ph.CO].
35. L. Cosmai, **G. Fanizza**, M. Gasperini and L. Tedesco, “*Discriminating different models of luminosity-redshift distribution*”, Class. Quant. Grav. **30** (2013) 095011, arXiv:1303.5484 [gr-qc].

RESEARCH STATEMENT

Non-Linear CMB lensing - My work on CMB lensing concerns several aspects: in particular, in [1], I have developed a formalism which allows to iteratively calculate the deflection angle up to arbitrary order in perturbation theory. In this context, this theoretical study is well-posed and in perfect agreement with the cornerstone formula of weak lensing theory, i.e. the lens equation. The advantage of the method presented in my work is that it allows to obtain the full expression for deflection angles at any arbitrary order in perturbation theory, so that even small effects like time delay can be taken into account order by order. This is a non trivial feature: indeed, when higher order lensing corrections are considered, we need to be sure that lower order sub-leading effects can be still safely neglected. Apart from these new contributions, my result is consistent with the lens equation, which instead is valid only for lensing corrections.

Starting from the results obtained in the abovementioned work, I have applied my analytical expressions to investigate how much these next-to leading order terms change the CMB spectra. In particular, in [2], I have systematically classified the higher order terms and shown which of them are relevant. More specifically I have found new pure post-Born contributions which have been missed in previous work and which turn out to be the most important corrections. Among these contributions, there are also terms involving higher-order n -th point correlation functions for deflection angles which lead to a strongly non-gaussian behavior. In this work, I have provided the very first analytical derivation for these terms which can not be taken into account neither by the Halofit model nor via summation of ladder diagrams. After a numerical evaluation, an interesting property becomes manifest: indeed, even if each term is as relevant as expected ($\sim 1\%$), their mathematical structure exhibits a partial group-by-group cancellation which attenuates the amplitude of the effect. In particular, my major result in this work is that the 3-point correlation function terms are more relevant than the higher order 2-point ones by about one order of magnitude. Therefore, the usual strategy of taking into account the 2-point contributions by an exponential re-summation, as it is done within the conventional scheme, is no longer enough. A new method has to be found here. This preliminary analysis concerns only temperature perturbations. In a subsequent work [3], I have extended my analysis to polarization and considered also other contributions coming from higher order expansion of the metric. Among other things, I have found the same structure for these terms as the one obtained for the temperature anisotropies. This is a nice extension of what happens already at linear order. Moreover, it turns out in my analysis that terms from the higher order expansion of the gravitational potential are of the same order as the relevant post-Born effects. The procedure that I have followed here is completely analytical and a Monte-Carlo based numerical scheme has been adopted to evaluate the final analytical expressions for the multiple integrals. Because of the spin-2 nature of the polarization tensor, the structures along the photon path induce a rotation of this polarization with no correspondence in the temperature anisotropies, due to their scalar nature. In this sense, in [3] I have calculated this rotation angle β from the emission at the LSS to the observer detection. The very interesting results is that this rotation angle happens to be equal to laplacian of the curl source of the rotation angle. The same results has been derived with a different approach [4] and extended to linear vector and tensor perturbations.

Furthermore, I have also shown in a letter [5] that the cumulative effect of all the next-to leading order corrections can lead to a significant shift in the parameters estimation ($\sim 2\sigma$) according to the idealistic claimed configuration of the next generation CMB experiments. Even more fundamental, again in [5], I have shown how the total effect lead to a misinterpretation of a results about the curl part of the CMB polarization (so-called B-modes). Indeed, intrinsic primordial B-modes can appear in the CMB spectra just in case there is a background at the epoch of inflation from primordial gravitational waves, namely tensor perturbations of the metric. However, lensing (among other foregrounds) generates an induced B-mode which has nothing to do with the presence of primordial gravitational waves: it is then crucial to have control on this late time effect, in order to infer the correct information from experiments. In particular, the standard inflationary scenario predicts that the amount of primordial B-modes is

governed by the *tensor-to-scalar ratio* r , i.e. the ratio between the amplitude of tensor and scalar perturbations. My research has shown that next-to leading order effects can mimic a primordial r of order $10^{-4} - 10^{-3}$, depending on the details of the experiment (e.g. the region of sky considered etc). This induced effect is of the same order as the limits which next-generation experiment will be able to achieve. Hence it cannot be over-emphasized how important it is to correctly model this term. In the letter [5] I also have discussed that polarization rotation presents a frame dragging effect and its detection which should be possible with planned future CMB experiment will represent an important test of General Relativity.

Large Scale Structures (LSS) - On the other hand, my results about Relativistic Effects in the Large Scale Structure of the Universe started to be collected during my PhD activity. In particular, I have studied the fundamental properties of the so-called Geodesic Light-Cone (GLC) gauge [6-8]: this consists of a coordinate system which is adapted to describe exactly the propagation of light-like signals along the past light-cone of the observer. Because of this, within this coordinate system, physical observables involving propagation of photon can be written exactly, beyond the perturbative scheme. Indeed, in [6], I have found an exact solution for the Jacobi map within this coordinate system. With this results, I have provided also the exact expression for the angular/luminosity distance. After that, I have used my results to express luminosity distance at the second-order in the Poisson Gauge and I have shown that my results generalize the previous ones by taking into account also terms proportional to the second-order peculiar velocity of the observer. Nicely, all these new observer terms correctly agree with a boost performed on a solid angle as seen by the observer, which is deeply involved in the definition of the angular distance.

Moreover, in [7], I have extended the results obtained in [6] and provided its application for the description of weak lensing quantities. Again, thanks to the properties of the GLC gauge, I have obtained non-perturbative expression for lensing convergence, shear, vorticity and magnification. Thanks to a coordinate transformation between the GLC coordinates and the Lemaître-Tolman-Bondi (LTB) ones, I have applied my results to some interesting configurations where an arbitrarily large strong inhomogeneous region is far from the observer's position. This application has been done having in mind the so-called *fitting problem*, in order to understand how much inhomogeneities do affect our observations along the past light-cone. The use of a particular radially inhomogeneous model as the LTB one is crucial in order to show some strongly non-linear behaviors which cannot be shown within a pure perturbative scheme. Furthermore, in [8], I firstly have studied the formal properties of the GLC gauge. In particular, starting from an alternative derivation of it, I have explored all its possible residual gauge freedoms and I have classified them. Beyond these geometrical aspects, I have applied my results obtained in [6] now to a strongly anisotropic Bianchi I model.

The GLC gauge has revealed its power not only in describing light-like signals, but also Ultra-Relativistic (UR) particles. In [9], I have considered the case of two UR particles emitted at the same time by the same source. The idea is measuring their time delay at the arrival time as soon as they reach the observed position. Within the GLC gauge, I have provided the full exact formula for this measurement in the UR limit for two different particles. The really interesting property is that this result nicely factorizes the geometrical distortions, related to the inhomogeneities, and the particles properties, entirely described by the Lorentz factor of each particles. This behavior was already known at the background level, for the FRW models. The fact that it happens to be exact is definitely non trivial and absolutely interesting. Indeed, thanks to this factorization, I have shown that it is possible to have a good control of the intrinsic dispersion of this measurement, due to the stochastic properties of inhomogeneities along the line-of-sight. This error is not only independent on the properties of the particles, like their masses, but is also small enough to improve the knowledge about parameters in both fields, cosmology and/or high-energy physics. Moreover, at linear level, the effect is dominated by redshift-space distortion and there is no lensing at all. In this way, this *time-of-flight distance* provides a new tool for measuring distances in the universe which is deeply different from angular distance, dominated instead by lensing. Finally, investigating this new measurements will be very important in the new era of cosmology about multi-messenger sources. On one hand, combining results about different UR particles, for instance different neutrino

species, can improve our understanding about their masses and their hierarchy. This has fundamental consequences also in the understanding of power spectrum on small scales. On the other hand, the discovery of new sources, as black holes or binary pulsars mergers, have just opened an entire new region of investigations for this distance measurement which can be constrained, or combined, with the well-know standard ones, namely angular and luminosity ones. In this way, consistency checks can be built also as null-test for different cosmological models.

Formal aspects of LSS theory - Starting from the above-mentioned results, my subsequent research about Relativistic Effects in LSS has been devoted to build a perturbative scheme within the GLC gauge [10, 11]. Indeed, all the results obtained so far make use of a coordinate transformation, in order to deal with solvable models. This is because Einstein equations are not directly solved in the GLC gauge. In order to overcome this point, my idea is to write the Einstein equations in the GLC gauge and build a perturbative theory in this coordinate system. This task is not trivial at all. In particular, standard perturbation theory consider a 1+3 spacetime foliation. Instead, in [11] I have shown that GLC coordinates provide an exact 1+1+2 foliation of spacetime. This led to a foliation of the fully inhomogeneous spacetime which allows to write the dynamics of General Relativity entirely on the observer past light-cone (see [11]). These results are complementary to the classification of well-defined averages on null hypersurfaces discussed in [12]. In this way, [11] provides the evolution of perturbations along the observer's past light-cone whereas [12] allows to perform averages of cosmological observables which are gauge invariant and fully covariant. Both these works are cornerstone towards the description of cosmological inhomogeneities along the light-cone, where most of our datasets lives.

On the other hand, in [10] I have provided a geometrical framework to build linear gauge invariant perturbations along the observer's past light-cone. It turns out that metric components in the GLC gauge are naturally adapted to be identified as gauge invariant linear perturbations. This combines the simplicity of GLC coordinates with their geometrical properties, promoting GLC gauge to a natural framework where cosmological light-like observables should be studied.

Finally, with the results of [12] I have shown that the averaged inhomogeneities can affect the Hubble-Lemaître diagram with a relative correction of order 10^{-3} and this result is quite insensitive to the particular formal choice done for the estimation of the averages. This result is in good agreement with the outcome of numerical simulations and provides the ground for their analytical understanding. Moreover, the contribution from the average of inhomogeneities is of the same order of the precision which will be reachable by the upcoming LSS surveys. This renders my analysis important not only from the formal point of view, but also in regard of the data-analysis. Indeed, taking into account these effects is crucial to draw the correct conclusions, also in view of the search for extension of General Relativity and the understanding of the nature of Dark Energy. In my subsequent work [13], I have also evaluated the impact of the inhomogeneities on the theoretical variance for the estimation of cosmological parameters from LSS surveys. This is currently of high importance since the estimation of this effect could play a role in the understanding of the upraising Hubble tension. What I have forecasted and discussed in [13] is that realistic forthcoming surveys will be marginally affected by the the presence of inhomogeneities for what concerns the variance of the Hubble constant. This is an important since this is not the case for current surveys, where closer sources are investigated.

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- [1] G. Fanizza, M. Gasperini, G. Marozzi, and G. Veneziano, [JCAP **08**, 020 \(2015\)](#), [arXiv:1506.02003 \[astro-ph.CO\]](#).
 - [2] G. Marozzi, G. Fanizza, E. Di Dio, and R. Durrer, [JCAP **09**, 028 \(2016\)](#), [arXiv:1605.08761 \[astro-ph.CO\]](#).
 - [3] G. Marozzi, G. Fanizza, E. Di Dio, and R. Durrer, [Phys. Rev. D **98**, 023535 \(2018\)](#), [arXiv:1612.07263 \[astro-ph.CO\]](#).
 - [4] E. Di Dio, R. Durrer, G. Fanizza, and G. Marozzi, [Phys. Rev. D **100**, 043508 \(2019\)](#), [arXiv:1905.12573 \[astro-ph.CO\]](#).
 - [5] G. Marozzi, G. Fanizza, E. Di Dio, and R. Durrer, [Phys. Rev. Lett. **118**, 211301 \(2017\)](#), [arXiv:1612.07650 \[astro-ph.CO\]](#).
 - [6] G. Fanizza, M. Gasperini, G. Marozzi, and G. Veneziano, [JCAP **11**, 019 \(2013\)](#), [arXiv:1308.4935 \[astro-ph.CO\]](#).
 - [7] G. Fanizza and F. Nugier, [JCAP **02**, 002 \(2015\)](#), [arXiv:1408.1604 \[astro-ph.CO\]](#).

- [8] P. Fleury, F. Nugier, and G. Fanizza, [JCAP **06**, 008 \(2016\)](#), [arXiv:1602.04461 \[gr-qc\]](#)
- [9] G. Fanizza, M. Gasperini, G. Marozzi, and G. Veneziano, [Phys. Lett. B **757**, 505 \(2016\)](#), [arXiv:1512.08489 \[astro-ph.CO\]](#)
- [10] G. Fanizza, G. Marozzi, M. Medeiros, and G. Schiaffino, [JCAP **02**, 014 \(2021\)](#), [arXiv:2009.14134 \[gr-qc\]](#)
- [11] E. Mitsou, G. Fanizza, N. Grimm, and J. Yoo, [Class. Quant. Grav. **38**, 055011 \(2021\)](#), [arXiv:2009.14687 \[gr-qc\]](#)
- [12] G. Fanizza, M. Gasperini, G. Marozzi, and G. Veneziano, [JCAP **02**, 017 \(2020\)](#), [arXiv:1911.09469 \[gr-qc\]](#)
- [13] G. Fanizza, B. Fiorini, and G. Marozzi, [Phys. Rev. D **104**, 083506 \(2021\)](#), [arXiv:2102.12419 \[astro-ph.CO\]](#)

April 19, 2022

PhD Giuseppe Fanizza

CURRICULUM VITAE – FEDERICO GALLI

PERSONAL INFORMATION

Full Name: Federico Galli
Birth: OMISSIS
Citizenship: Italian and Belgian
Family: OMISSIS
Languages: Italian (native), English (fluent), French (fluent)
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ACADEMIC POSITIONS

10/2019 - 09/2022 **Researcher - MSCA COFUND Fellini fellow** - INFN Firenze, Italy.
Ricercatore di III livello, fixed term.
01/2016 - 09/2019 **Postdoctoral fellow** - Perimeter Institute for Theoretical Physics, Canada.
10/2013 - 09/2016 **FWO Postdoctoral fellow** - ITF, KU Leuven, Belgium.
From 01/2016 jointly with and at Perimeter Institute.

EDUCATION

10/2008 - 09/2013 **PhD in Sciences** - Vrije Universiteit Brussel, Belgium.
Degree “Doctor in de Wetenschappen”, 15/5/2013 with the greatest distinction
Thesis: Applications of the AdS/CFT correspondence to non-equilibrium physics at strong coupling.
Advisor: Prof. Ben Craps.
Equivalent to the Italian “Dottore di Ricerca”, MIUR Prot. n 0002626-07/11/2016
10/2005 - 10/2008 **Master degree in Physics**, Università degli Studi di Milano, Italy.
Degree “Dottore Magistrale in Fisica”, classe laurea specialistica 20S, 3/10/2008 with grade 110/110 cum laude
Thesis: BPS solutions in Super-Yang-Mills theories
Advisor: Prof. Dietmar Klemm
10/2002 - 12/2005 **Bachelor degree in Physics**, Università degli Studi di Milano, Italy.
Degree “Dottore in Fisica”, classe di laurea L30, 13/12/2005 with grade 110/110 cum laude
Thesis: Non-homogeneous cosmological solutions
Advisor: Prof. Daniela Zanon

PROFESSIONAL QUALIFICATIONS

- 01/2020** **Abilitazione scientifica nazionale**, Italy.
Settore 02/A2: fisica teorica delle interazioni fondamentali, II fascia.
- 01/2016** **Qualification aux fonctions de Maître de Conférences**, France.
Section 29, constituants élémentaires.

AWARDS

- 2014** **Solvay Awards 2013**
Awarded by Solvay to PhD students of the faculty of Science and Bio-Engineering Sciences of the ULB and VUB, Brussels, Belgium, for the quality of their research work (3000€).

PERSONAL FUNDINGS

- 2019** **Individual Marie Skłodowska-Curie COFUND FELLINI Fellowship**
PI of the project “Holographic conformal field theories”. Awarded on a competitive basis with peer review process (received full marks and ranked first of ~ 200 applications). 3 years full salary (value $\sim 160\text{k€}$) + personal research budget of 13200€/year.
- 2013** **Individual Fellowship of the Research Foundation Flanders FWO**
PI of the project “Novel applications of holography to out-of-equilibrium physics”. Awarded on a competitive basis with peer review process. 3 years full salary (value $\sim 200\text{k€}$) + personal research budget of 4000€/year.
- 2009** **Individual PhD Fellowship of the Research Foundation Flanders FWO**
Project “Space-time as an emergent phenomenon in string theory”. Awarded on a competitive basis. 4 years full salary + personal research budget of 3600€/year.

Travel and visiting grants obtained on a competitive basis

- 2017** **Young Investigator Training Program**
For a research stay at SISSA, local hosts P. Calabrese and E. Tonni, and attending the GGI program “New Developments in $\text{AdS}_3/\text{CFT}_2$ Holography”. Travel and local expenses, 04-05/2017 (4000€).
- 2016** **KU Leuven Junior Mobility Programme**
To support a long-term research stay at Perimeter Institute. Monthly mobility allowance and travel expenses, 01-08/2016 (8000€).

RESEARCH INTERESTS

- AdS/CFT correspondence
- Black holes and information
- Conformal field theory
- Entanglement measures in holography and quantum field theory
- Out-of-equilibrium dynamics at strong coupling

SCIENTIFIC PUBLICATIONS

In all publications authors are listed in alphabetical order, as customary in the hep-th community.

- [1] A. Bernamonti, F. Bigazzi, D. Billo, L. Faggi and F. Galli, “Holographic and QFT complexity with angular momentum,” JHEP **11** (2021) 037 doi:10.1007/JHEP11(2021)037 [arXiv:2108.09281 [hep-th]].
- [2] A. Bernamonti, F. Galli, J. Hernandez, R. C. Myers, S. M. Ruan and J. Simón, “Aspects of The First Law of Complexity,” J. Phys. A: Math. Theor. **53** (2020), 294002 doi:10.1088/1751-8121/ab8e66 [arXiv:2002.05779 [hep-th]].
Invited contribution to the special issue: *A Passion for Theoretical Physics: In Memory of Peter G. O. Freund*
- [3] A. Bernamonti, F. Galli, J. Hernandez, R. C. Myers, S. M. Ruan and J. Simón, “First Law of Holographic Complexity,” Phys. Rev. Lett. **123** (2019) no.8, 081601 doi:10.1103/PhysRevLett.123.081601 [arXiv:1903.04511 [hep-th]].
- [4] A. Bagrov, B. Craps, F. Galli, V. Keränen, E. Keski-Vakkuri and J. Zaanen, “Holographic pump probe spectroscopy,” JHEP **07** (2018) 065 doi:10.1007/JHEP07(2018)065 [arXiv:1804.04735 [hep-th]].
- [5] A. Bernamonti, F. Galli, R. C. Myers and J. Oppenheim, “Holographic second laws of black hole thermodynamics,” JHEP **07** (2018) 111 doi:10.1007/JHEP07(2018)111 [arXiv:1803.03633 [hep-th]].
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Inspire-hep <https://inspirehep.net/authors/1065226>

Google scholar: <https://scholar.google.com/citations?user=b8hj0qAAAAAJ&hl=en>

INVITED SEMINARS AND CONFERENCE TALKS

- 09/2021** “Aspects of holographic complexity”. Invited seminar at the international conference *Workshop on Black Holes, BPS and Quantum Information*, Instituto Superior Técnico, University of Lisbon, Portugal (online).
- 02/2020** “The first law of complexity”. Invited seminar at the international conference *Workshop Gravity, Quantum Fields and Information IV*, Max Planck Institute for Gravitational Physics, Potsdam, Germany.
- 07/2018** “Holographic second laws of black hole thermodynamics”. Contributed talk at the international conference *Gauge/Gravity Duality 2018*, Julius-Maximilians Universität Würzburg, Germany.
- 07/2018** “Holographic second laws of black hole thermodynamics”. Invited seminar at the international program *Entanglement in Quantum Systems Workshop*, Galileo Galilei Institute, Firenze, Italy.
- 06/2018** “Holographic second laws of black hole thermodynamics”. Invited seminar at the international conference *PASCOS 2018 - 24th International Symposium on Particles, Strings and Cosmology*, Case Western Reserve University, Cleveland OH, USA.
- 05/2017** “New notions of entanglement and non-minimal geodesics from 2d CFT”. Invited seminar at Università di Firenze, Italy.
- 04/2017** “Entanglement scrambling in 2d CFT”. Invited seminar at SISSA, Trieste, Italy.
- 11/2016** “Entwinement and non-minimal geodesics from 2d CFT”. Group seminar at Perimeter Institute for Theoretical Physics, Canada.
- 04/2016** “Entanglement scrambling in 2d CFT”. Invited seminar at the international conference *Northeast Gravity Workshop*, Amherst Center for Fundamental Interactions, UMass, Amherst MA, USA.
- 11/2015** “Entanglement dynamics in 2d CFT”. Invited seminar at Università di Torino, Italy.
- 05/2015** “Holographic entanglement entropy after a quench in 2d CFT”. Contributed talk at the national conference *Two days of Theoretical and Mathematical Physics in Flanders*, Ostend, Belgium.
- 04/2015** “Holographic entanglement entropy in excited states from 2d CFT”. Invited seminar at ITF Utrecht University, The Netherlands.
- 04/2014** “Mutual information in quantum quenches”. Poster at the international conference *New perspective on thermalization*, Aspen Center for Physics, Aspen CO, USA.
- 04/2013** “Holographic thermalization of mutual and tripartite information in 2d CFTs”. Contributed talk at the national conference *Workshop on Theoretical and Mathematical Physics in Flanders*, Oostduinkerke, Belgium.

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- 09/2012** “Holographic thermalization of mutual and tripartite information in 2d CFTs”. Contributed talk at the international conference *XVIII European Workshop on String Theory*, Corfu Summer Institute, Greece.
 - 03/2012** “Holographic thermalization of entanglement entropy, mutual and tripartite information in 2d CFTs”. Invited seminar at *KUL-ULB-UMONS-VUB-SOLVAY joint hep-th seminars*, Université Libre de Bruxelles, Belgium.
 - 05/2011** “Hairy Black Holes in AdS”. Contributed talk at the national conference *Workshop on Theoretical and Mathematical Physics in Flanders*, Oostduinkerke, Belgium.

TEACHING AND SUPERVISING

- 2020 - 2021** **Elements of quantum gravity course** - Università degli Studi di Firenze, Italy. Master in Physics, with A. Bernamonti and F. Bigazzi. Lectures on entanglement entropy in CFT and holography. 2 years, 4h in 2020 and 6h in 2021 and exams.
- 2013 - 2015** **Exercises and lectures for Relativity course** - KU Leuven, Belgium. Master in Physics, Prof. T. Hertog. 3 years, 22h/year of exercises and 8h of lectures. *Tasks: Preparing and delivering in class black-board examples, and lectures in substitution of T. Hertog. Preparing and grading home assignments handed to students during the course. About 20 students/year.*
- 2013** **Supervisor of a Bachelor in Physics project** - KU Leuven, Belgium. “Newtonian and relativistic stars”, students E. Meeus and J. Vanherck. *Tasks: Devising the project in a form of extra-curricular study and exercise. Guiding the students throughout the project, for the write-up and final presentation. Weekly meetings.*
- 2009 - 2012** **Exercises for General Relativity course** - Vrije Universiteit Brussel, Belgium. Master in Physics, Prof. B. Craps. 4 years, 20h/year of exercises in class. *Tasks: Preparing and delivering in class black-board examples. Preparing and grading home assignments handed to students twice during the course and counting towards the final exam. About 10 students/year.*
- 2010 - 2011** **Co-supervisor of a Bachelor thesis in Physics** - Vrije Universiteit Brussel, Belgium. “Decoherence and interpretation of quantum mechanics”, student I. Goessens. *Tasks: Guiding the student in all parts of the project through regular meetings over a period of about 3 months. Informal participation in the degree defence’s jury.*

ORGANISING ACTIVITY AND REFEREEING

- 2015 - today** **Reviewer for International Journals:** Class. Quant. Grav., Eur. Phys. J. C, JHEP, Nucl. Phys. B, Phys. Rev. D, Phys. Rev. Lett.
- 2019 - today** **Organizer** of the seminars of the theory group of the University and the INFN section of Firenze, Italy.

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- 2018** **PhD Thesis Examiner** of the dissertation of Jarkko Järvelä, Helsinki Institute of Physics, University of Helsinki, Finland.
 - 2017 - 2018** **Organizer** of the *Quantum Fields and Strings group meetings* at Perimeter Institute for Theoretical Physics, Canada.
 - 2014 - 2015** **Organizer** for KUL of the weekly *KUL-ULB-UMONS-VUB-SOLVAY joint hep-th seminars*, Belgium.
 - 2010 - 2012** **Co-organizer of the summer school** *Modave Summer School in Mathematical Physics*, editions VI, VII, and VIII, Belgium.

OUTREACH

- 2021** **Outreach talk** “Buchi neri e informazione quantistica” (Black holes and quantum information) at *Bright-Night*, European researchers’ night in Firenze, Italy.
- 2017** **Outreach activity** *Ask Me I’m a Scientist* initiative at *Perimeter Public Lecture Series*, Canada.

WORKSHOPS AND RESEARCH STAYS

Invited and/or financially supported participations excluding those as speaker, recent selection.

- 2022** *Workshop Qubits on the Horizon*, It from Qubit and Scanning New Horizons Collaborations, Aruba.
- 2021** *It from Qubit 2021 Annual Meeting*, Simons Foundation, New York NY, USA (remote).
- 2020** *Complexity from Quantum Information to Black Holes*, Lorentz Center, Leiden, Netherlands (became remote).
- 2019** *Workshop on Qubits and Spacetime*, IAS, Princeton, and *It from Qubit 2019 Annual Meeting*, Simons Foundation, New York NY, USA.
- 2017** *New Developments in AdS_3/CFT_2 Holography*, Galileo Galilei Institute for Theoretical Physics, Firenze, Italy.
- 2016** *Entanglement in Field Theory and Gravity*, Simons Center for Geometry and Physics, Stony Brook, and *It from Qubit 2016 Annual Meeting*, Simons Foundation, New York NY, USA.
- 2016** *Quantum Information in String Theory and Many-body Systems*, Yukawa Institute for Theoretical Physics, Kyoto University, Giappone.
- 2016** Research visit at UPenn, Philadelphia PA, USA, host Vijay Balasubramanian.
- 2015** *Holographic Methods for Strongly Coupled Systems*, Galileo Galilei Institute for Theoretical Physics, Firenze, Italy.

REFERENCES

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Waterloo ON, Canada
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Firenze, April 18, 2022

Federico Galli

Giovanni Grilli di Cortona

Curriculum Vitae

PART I – GENERAL INFORMATION

NAME: Giovanni
SURNAME: Grilli di Cortona
PLACE AND DATE OF BIRTH: OMISSIS
CITIZENSHIP: Italian
PERMANENT ADDRESS: OMISSIS
MOBILE PHONE NUMBER: OMISSIS
EMAIL: grillidc@lnf.infn.it
SPOKEN LANGUAGES: italian, english
ORCID: 0000-0003-2408-6171
FISCAL CODE: OMISSIS

PART II – EDUCATION

OCT. '12 - SEPT. '16 **PhD in Theoretical Particle Physics**
Advisor: G. Villadoro (International Centre for Theoretical Physics)
Institute: SISSA - Scuola Internazionale Superiore di Studi Avanzati
(International School for Advanced Studies), Via Bonomea 265, Trieste, Italy
Research activity: dark matter, supersymmetry, QCD axion

SEPT. '10 - OCT. '12 **Laurea Magistrale (Master degree)**
Advisors: L. Silvestrini, S. Mishima
Mark: 110/110 cum laude
Institute: University of Rome Sapienza, Physics Department,
Piazzale A. Moro 1, Rome, Italy
Research activity: electroweak precision observables

SEPT. '07 - SEPT. '10 **Laurea triennale (Bachelor degree)**
Advisors: G. Montani, M. Lattanzi
Mark: 110/110 cum laude
Institute: University of Rome Sapienza, Physics Department,
Piazzale A. Moro 1, Rome, Italy

PART III – APPOINTMENTS

JAN. '22 - JAN. '31 National Scientific qualification as associate in the Italian higher education system for the disciplinary field of 02/A2 - Theoretical physics of fundamental interactions (Abilitazione Scientifica Nazionale alle funzioni di professore universitario di seconda fascia nel Settore Concorsuale 02/A2 - FISICA TEORICA DELLE INTERAZIONI FONDAMENTALI)

- Nov. '20 - **Cabibbo fellow**
Institute: INFN - Laboratori Nazionali di Frascati,
via Fermi 54, 00044 Frascati, Italy
Research activity: dark matter in supersymmetric Twin-Higgs models, physics at the LHC, direct dark matter searches exploiting the Migdal effect in liquid Argon experiments, neutrino physics at future facilities, flavourful axion models, exotic signatures at hadron colliders (semivisible jets) and machine learning techniques, effective field theory, dark photon models, models to solve the anomalous magnetic moment of the muon problem
- JUNE '20 - member of the experimental collaboration DarkSide, analysing the data for light dark matter searches exploiting the Migdal effect and photon Brehmsstrahlung, and for solar and galactic axions.).
- JAN. '12 - member of HEPfit (<http://hepfit.roma1.infn.it/>),
Principal Investigator Dr. Luca Silvestrini (INFN, Sezione di Roma 1).
- DEC. '18 - OTT. '20 **Postdoctoral Researcher**
Institute: Institute of Theoretical Physics - Faculty of Physics -
University of Warsaw, ul. Pasteura 5, PL-02-093 Warsaw, Poland
Research activity: dark matter in supersymmetric Twin-Higgs models, physics at the LHC, direct dark matter searches, Hidden Valley models, Migdal effect in liquid Argon experiments, neutrino physics, flavourful axion models, exotic signatures at hadron colliders (semivisible jets), effective field theory
- OCT. '16 - NOV. '18 **Postdoctoral Researcher**
Institute: Instituto de Física - Departamento de Física Matemática -
Universidade de São Paulo, P.O. Box 66318, 05315-970 São Paulo, SP, Brazil
Research activity: dark matter, LHC physics, direct and indirect dark matter searches, relaxion, Hidden Valley models, exotic signatures at hadron colliders (semivisible jets), effective theories, neutrino physics, low energy experiments.

PART IV – TEACHING EXPERIENCE

- APR. '18 two lectures of the Quantum Mechanics II course (Prof. E. Bertuzzo)
at San Paolo University (in english, for Master and PhD students):
4 hours.
- AUG. - NOV. '18 teaching assistant at the Quantum Mechanics I course (Prof. E. Bertuzzo)
at San Paolo University (in english, for Master and PhD students):
6 hours per week of lessons and meeting with students;
- '17 - '19 assisting in the supervision of C. Caniu (PhD student of Prof. Bertuzzo
at San Paolo University, PhD obtained in 2019);
- NOV. '19 - SEPT. '20 assisting in the supervision of Michal Lukawski, Master student of Dr. Badziak
at Warsaw University;
- SEPT. '20 referee for the final exam (master thesis) of Michal Lukawski
(student of Dr. Badziak at Warsaw University)
- JULY - OCT. '21 co-supervisor for the bachelor thesis (laurea triennale) of Pierfrancesco Martini
(student of Prof. Messina at University of Rome Sapienza)
- NOV. '21 three lectures on Dark Matter for the 'Weak interactions in the Standard
model and beyond' course (Prof. M. Nardecchia) at Sapienza University of
Rome (in english, for Master students): 5 hours.
- NOV. '19 - APR. '22 assisting in the supervision of Lucas Magno, Master student of Prof. Bertuzzo
at San Paolo University;

PART V – FUNDING INFORMATION

1. Cabibbo Fellowship – two years of postdoctoral fellowship at the Laboratori Nazionali di Frascati and one year at the INFN - Rome, starting 1st November 2020;
2. Workshop participation grant – Galileo Galilei Institute Workshop ‘New frontiers in the search for DM’, Firenze, Italy, 26 Agosto - 7 September 2019, ~ 1050 Euro;
3. SPRINT-FAPESP travel grant (PI Prof. Eboli and Prof. Belyaev) between the University of São Paulo and Southampton, years 2017-2018 (travel, meals and accommodation in Southampton);
4. winner of the PhD fellowship in Theoretical Particle Physics at SISSA, started in the academic year 2012-2013 (4 years of fellowship);
5. merit based scholarship “Percorsi di eccellenza” for the years 2011-2012, Sapienza University of Roma, Italy (last year of University fees reimbursed $\sim 2k$ Euro);¹
6. merit based scholarship “Percorsi di eccellenza” per gli anni 2008-2010, Sapienza University of Roma, Italy (ast year of University fees reimbursed $\sim 2k$ Euro).¹

PART VI – RESEARCH ACTIVITIES

Hierarchy problem: phenomenological studies of various models that solve or ameliorate the hierarchy problem (supersymmetric models, twin Higgs models, relaxion models).

Dark Matter: study of several models that have dark matter candidates (axions, neutralinos in supersymmetric models, models with dark mesons, Dark Matter Effective Field Theory). Analysis of the Darkside-50 full exposure data (within the Darkside collaboration) for low mass ($\mathcal{O}(0.1)$ GeV - $\mathcal{O}(10)$ GeV) Dark Matter (including the Migdal effect).

Neutrino physics: investigation of Effective Field Theories at the Dune experiment and phenomenological studies of Coherent Elastic Neutrino Nucleus Scattering at future facilities.

Axions: computation of the mass and couplings of the QCD axion, analysis of the interplay of flavorful axion models with Higgs physics in models that address the stellar cooling hint anomalies.

Exotic collider signatures: study of the collider phenomenology of Hidden Valley models producing semivisible jets (dark jets that have a long lived components that escape the detector and a short lived component that decays to SM state producing an ordinary jet), study of event-level variables for semivisible jets exploiting machine learning techniques.

Dark photon: investigation of the effect of operators of dimension larger than 4 that include the dark photon field strength on the phenomenology of dark photons; study of dark photon models that may decrease the muon $g - 2$ anomaly.

Collaborations

SEPT. 2020	proposal to use the Cygno prototypes in order to detect the Migdal effect from neutron-nuclei scattering (link).
JUNE 2020	collaborating with the DarkSide experiment on the analysis for light dark matter exploiting the Migdal effect and photon Brehmsstrahlung, and on the analysis of solar and galactic axions.
JANUARY 2012	member of HEPfit (http://hepfit.roma1.infn.it/), Principal Investigator Dr. Luca Silvestrini (INFN, Sezione di Roma 1).

¹ This program was an integrative course of Master’s Degree in Physics and consisted of additional educational activities to those of the same course of study, which aimed to enhance the talent of students who have demonstrated to be excellent in the previous years of university.

PART VII – SUMMARY OF SCIENTIFIC ACHIEVEMENTS

Published articles and proceedings

1. G. Grilli di Cortona, A. Messina, S. Piacentini, *Exploiting the Migdal effect to improve the sensitivity to light dark matter*, **PoS PANIC2021 (2022) 051**;
2. F. D. Amaro et al., *The CYGNO Experiment*, **Instruments** **6 (2022) 1, 6**, arXiv:2202.05480;
3. G. Grilli di Cortona, A. Messina, S. Piacentini, *Improving the sensitivity to light dark matter with the Migdal effect*, **J.Phys.Conf.Ser.** **2156 (2021) 1, 012038**;
4. D. Barducci, E. Bertuzzo, G. Grilli di Cortona, G. M. Salla, *Dark Photon bounds in the dark EFT*, **JHEP** **12 (2021) 081**, arXiv:2109.04852;
5. M. Badziak, G. Grilli di Cortona, M. Tabet, R. Ziegler, *Flavor-Violating Higgs Decays and Stellar Cooling Anomalies in Axion Models*, **JHEP** **10 (2021) 181**, arXiv:2107.09708, **cited by 1** (Scopus);
6. G. Grilli di Cortona, A. Messina, S. Piacentini, *Migdal effect: improving the sensitivity to light dark matter with liquid argon*, **JHEP** **11 (2020) 034**, arXiv:2006.02453, **cited by 17** (Scopus);
7. M. Badziak, G. Grilli di Cortona, K. Harigaya, *Natural Twin Neutralino Dark Matter*, **Phys. Rev. Lett.** **124 (2020) no.12, 121803**, arXiv:1911.03481 [hep-ph], **cited by 8** (Scopus);
8. J. de Blas, D. Chowdhury, M. Ciuchini, O. Eberhardt, M. Fedele, E. Franco, G. Grilli di Cortona, V. Miralles, S. Mishima, A. Paul, A. Penuelas, M. Pierini, L. Reina, L. Silvestrini, M. Valli, Y. Yokozaki, *HEPfit: a Code for the Combination of Indirect and Direct Constraints on High Energy Physics Models*, **Eur. Phys. J. C.** **80 (2020) 5, 456**, arXiv:1910.14012 [hep-ph], **cited by 47** (Scopus);
9. H. Beauchesne, G. Grilli di Cortona, *Classification of dark pion multiplets as dark matter candidates and collider phenomenology*, **JHEP** **02 (2020) 196**, arXiv:1910.10724 [hep-ph], **cited by 6** (Scopus);
10. A. Alves, O. Eboli, G. Grilli di Cortona, R. Moreira, *Indirect and monojet constraints on scalar lepto-quarks*, **Phys. Rev. D** **99 (2019) no.9, 09005**, arXiv:1812.08632 [hep-ph], **cited by 14** (Scopus);
11. H. Beauchesne, E. Bertuzzo, G. Grilli di Cortona, *Dark Matter in Hidden Valley models with stable and unstable dark mesons*, **JHEP** **1904 (2019) 118**, arXiv:1809.10152 [hep-ph], **cited by 16** (Scopus);
12. A. Belyaev, E. Bertuzzo, C. Caniu Barros, O. Eboli, G. Grilli di Cortona, F. Iocco, *Interplay of the LHC and non-LHC Dark Matter searches in the Effective Field Theory approach*, **Phys. Rev. D** **99 (2019) no.1, 015006**, arXiv:1807.03817 [hep-ph], **cited by 21** (Scopus);
13. A. Falkowski, G. Grilli di Cortona, Z. Tabrizi, *Future DUNE constraints on EFT*, **JHEP** **1804 (2018) 101**, arXiv:1802.08296 [hep-ph], **cited by 18** (Scopus);
14. H. Beauchesne, E. Bertuzzo, G. Grilli di Cortona, Z. Tabrizi, *Collider phenomenology of Hidden Valley mediators of spin 0 or 1/2 with semivisible jets*, arXiv:1712.07160 [hep-ph], **JHEP** **1808 (2018) 030**, **cited by 17** (Scopus);
15. E. Bertuzzo, C. Caniu Barros, G. Grilli di Cortona, *MeV dark matter: model independent bounds*, **JHEP** **1709 (2017) 116**, arXiv:1705.06325 [hep-ph], **cited by 23** (Web of Science);
16. H. Beauchesne, E. Bertuzzo, G. Grilli di Cortona, *Constraints on the relaxion mechanism with strongly interacting vector-fermions*, **JHEP** **1708 (2017) 093**, arXiv:1705.06325 [hep-ph], **cited by 15** (Scopus);
17. G. Grilli di Cortona, E. Hardy, A. Powell, *Dirac vs Majorana gauginos at a 100 TeV collider*, **JHEP** **1608 (2016) 014**, arXiv:1606.07090 [hep-ph], **cited by 20** (Web of Science);
18. G. Grilli di Cortona, E. Hardy, J. Pardo Vega and G. Villadoro, *The QCD axion, precisely*, **JHEP** **1601 (2016) 034**, arXiv:1511.02867 [hep-ph], **cited by 312** (Scopus);

19. G. Grilli di Cortona, *Searching SUSY from below*, **PoS(PLANCK 2015)054**;
20. G. Grilli di Cortona, *Hunting electroweakinos at future hadron colliders and direct detection experiments*, **JHEP 1505 (2015) 035**, arXiv:1412.5952, **cited by 24** (Scopus);

Total Number of published papers: 17 (Scopus)

Total Impact Factor per Product: 93.9 (Web of Science)

Average Impact Factor: 5.52 (Web of Science)

Total Citations: 557 (max(Scopus, Web of Science))

Average Citation per Product: 32.76 max(Scopus, Web of Science)

Hirsch index: 12 (Web of Science)

Preprints and work in progress

1. DarkSide50 collaboration, *Search for low-mass dark matter WIMPs with 10 ton-day exposure of DarkSide-50*, in prep;
2. DarkSide50 collaboration, *Search for dark matter particle interactions with electron final states with DarkSide-50*, in prep;
3. DarkSide50 collaboration, *Search for dark matter-nucleon interactions via Migdal effect with DarkSide-50*, in prep;
4. L. Darmé, G. Grilli di Cortona, E. Nardi and C. Smarra, *The axion flavour connection*, in prep;
5. G. Grilli di Cortona and E. Nardi, *Probing light mediators at the MUonE experiment*, arXiv:2204.04227, **submitted to PRL**;
6. G. Albouy et al., *Theory, phenomenology, and experimental avenues for dark showers: a Snowmass 2021 report*, arXiv:2203.09503, Contribution to 2022 Snowmass Summer Study;
7. C.A.J.O'Hare et al., *Recoil imaging for dark matter, neutrinos, and physics beyond the Standard Model*, arXiv:2203.05914, Contribution to 2022 Snowmass Summer Study;
8. M. Badziak, G. Grilli di Cortona, K. Harigaya, M. Lukowski, *Charged dark matter in supersymmetric Twin Higgs models*, arXiv:2202.10488, **submitted to JHEP**;
9. L. Darmé, G. Grilli di Cortona and E. Nardi, *The muon $g-2$ anomaly confronts new physics in $e^\pm$ and $\mu^\pm$ final states scattering*, arXiv:2112.09139, **submitted to JHEP**;
10. E. Bertuzzo, G. Grilli di Cortona, L. Magno, *Probing light vector mediators with coherent scattering at future facilities*, arXiv:2112.04020, **submitted to JHEP**;
11. H. Beauchesne, G. Grilli di Cortona, *Event-level variables for semivisible jets using anomalous jet tagging*, arXiv:2111.12156, Contribution to 2022 Snowmass Summer Study;

Scientific visits and Stages

1. visit at Padova University, Italy, 4th - 6th July 2018;
2. visit at the Humboldt University of Berlin, Germany, 3rd - 19th June 2018;
3. visit at the CERN Theory Group, Geneva, CH, 28th May - 2nd June 2018 ;
4. visit at the Southampton University, UK, 14th - 20th May 2018;
5. visit at the DESY Theory Group, Hamburg, Germany, 18th - 20th October 2017;
6. visit at Mainz University, Germany, 16th - 18th October 2017;

7. visit at GRAPPA (University of Amsterdam), Netherland, 9th - 13th October 2017;
8. visit at LPTHE, Paris, France, 1st - 7th October 2017;
9. visit at the University of Southampton, UK, 16th - 30th September and 23rd - 25th October 2017;
10. summer visitor at the Department of Theoretical Physics of Fermilab, USA, 1st - 29th July 2017;
11. summer student at the Meg experiment, Paul Scherrer Institut, 5232 Villigen PSI, Switzerland, 1st August - 15th September 2011
Research activity: data analysis (calibration of the scintillator counters used for the alignment of the MEG drift chamber hit resolution, study of the $\pi^0 \rightarrow e^+e^-\gamma$ decays taken during the MEG charge exchange run).

Schools, conferences and workshops

1. International Conference on Topics in Astroparticle and Underground Physics, Valencia, Spain, August 26th-September 3rd
Talk: *Improving the sensitivity to light dark matter with the Migdal effect*;
2. SUSY 2021, Beijing, China, August 23th - 27th
Talk: *Improving the sensitivity to light dark matter with the Migdal effect*;
3. DM@LHC workshop, DESY, Amburgo, Germany, 2nd-5th June 2020 (online due to Covid).
Invited Talk: *Strongly coupled dark sectors*;
4. Scalars Conference, University of Warsaw, 11th-14th September 2019.
Talk: *Hidden valley phenomenology: from colliders to cosmology*, 13th September 2019;
5. Workshop 'New frontiers in the search for DM', Firenze, Italy, 26th August - 7th September 2019.
Invited Talk: *Hidden valley phenomenology: from colliders to cosmology*, 4th September 2019;
6. Workshop 'Light scalars: origin, cosmology, astrophysics and experimental probes', Benasque, Spain, 7th-13th April 2019.
7. II South American Dark Matter Workshop, ICTP-SAIFR, Sao Paulo, Brazil, 21st - 23rd November 2018.
Talk: *Dark mesons Dark Matter in Hidden Valley models*, 22nd November 2018;
8. NuFACT 2018 Workshop, Blacksburg, VA, USA, 12th - 18th August.
Invited Talk: *Future DUNE constraints on EFT*, 17th August 2018;
9. SUSY 2018, Barcelona, Spain, 23rd - 27th July 2018.
Talk: *Phenomenology of Hidden Valley models with semivisible jets*, 26th July 2018;
Talk: *Future DUNE constraints on EFT*, 24th July 2018;
10. Planck 2018, Bonn, Germany, 21st - 26th May 2018.
Talk: *Future DUNE constraints on EFT*, 24th May 2018;
11. Amsterdam-Paris-Stockholm Workshop, Kasteel Worden, Netherland, 11th - 13th October 2017.
Talk: *MeV Dark Matter: model independent constraints*, 12th October 2017;
12. Dark Matter Workshop, ICTP-SAIFR, São Paulo, Brasile, 10th - 13th May 2017
Invited Talk: *New trends in dark matter effective field theory*, 12 May 2017;
13. Dark Matter Day, ICTP-SAIFR, São Paulo, Brasile, 25th October 2016
Talk: *SUSY dark matter: Majorana or Dirac?*, 25th October 2016;
14. Planck 2016, Valencia, Spain, 23rd - 27th May 2016.
Talk: *The QCD axion: cool & hot*, 25th May 2016;

15. Higgs Tasting Workshop 2016, Benasque, Spain, 16th - 20th May 2016.
16. SUSY 2015, Tahoe City, USA, 24th - 28th August 2015
Talk: *Searching SUSY from below*, 27th August 2015;
17. Planck 2015, Ioannina, Greece, 25th - 29th May 2015
Talk: *Searching SUSY from below*, 27th May 2015;
18. Cargese International School for Theoretical Physics, Cargese, France, 14th - 26th July 2014.
Mini Talk: *Searching SUSY from below*, 17th July 2014;
19. Workshop on Frontiers of New Physics: Colliders and Beyond, ICTP, Trieste, Italy, 23rd - 27th June 2014.
20. GGI lectures on the theory of fundamental interactions, Firenze, Italy, 7th - 24th January 2014.
21. SUSY 2013, ICTP, Trieste, Italy, 26th - 31st August 2013;
22. pre SUSY School, ICTP, Trieste, Italy, 19th - 23th August 2013;
23. Workshop on Higgs and Beyond the SM Physics at LHC, ICTP, Trieste, 24th - 28th Italy, June 2013;
24. Summer School on Particle Physics, ICTP, Trieste, Italy, 10th - 21th June 2013.

Seminars

1. *Dark photons in the dark EFT*, Carleton University, Canada, 22nd Novembre 2021, online;
2. *Hidden Valley phenomenology: from colliders to cosmology*, University of Warsaw, Polonia, 17th January 2019;
3. *Phenomenology of Hidden Valley models with semivisible jets*, University of Padova, Italy, 4th July 2018;
4. *Phenomenology of Hidden Valley models with semivisible jets*, SISSA, Trieste, Italy, 20th June 2018;
5. *Phenomenology of Hidden Valley models with semivisible jets*, Humboldt University, Berlin, Germany, 14th June 2018;
6. *Phenomenology of Hidden Valley models with semivisible jets*, CERN Theory Group, Geneva, Switzerland, 31st May 2018;
7. *Constraints on a non QCD relaxion model*, DESY theory group, Amburgo, Germany, 19th October 2017;
8. *Constraints on a non QCD relaxion model*, Johannes Gutenberg Universität Mainz, Germany, 17th October 2017;
9. *Constraints on a non QCD relaxion model*, LHPTE, Parigi, France, 3rd October 2017;
10. *Constraints on a non QCD relaxion model*, Southampton, United Kingdom, 21st September 2017;
11. *Probing dark matter above TeV and below meV*, UAB, Barcelona, Spain, 4th December 2015;
12. *Probing dark matter above TeV and below meV*, University of Montpellier, France, 22nd November 2015;
13. *Probing dark matter above TeV and below meV*, Johannes Gutenberg Universität Mainz, Germany, 20th November 2015;
14. *Probing dark matter above TeV and below meV*, UC Davis, USA, 31st August 2015.

PART VIII – SELECTED PUBLICATIONS

1. D. Barducci, E. Bertuzzo, G. Grilli di Cortona, G. M. Salla, *Dark Photon bounds in the dark EFT*, **JHEP** **12** (2021) **081**, arXiv:2109.04852;
2. G. Grilli di Cortona, A. Messina, S. Piacentini, *Migdal effect: improving the sensitivity to light dark matter with liquid argon*, **JHEP** **11** (2020) **034**, arXiv:2006.02453, **cited by 17**;
3. M. Badziak, G. Grilli di Cortona, K. Harigaya, *Natural Twin Neutralino Dark Matter*, **Phys. Rev. Lett.** **124** (2020) **no.12**, **121803**, arXiv:1911.03481 [hep-ph], **cited by 8**;
4. A. Alves, O. Eboli, G. Grilli di Cortona, R. Moreira, *Indirect and monojet constraints on scalar leptoquarks*, **Phys. Rev. D** **99** (2019) **no.9**, **09005**, arXiv:1812.08632 [hep-ph], **cited by 14**;
5. H. Beauchesne, E. Bertuzzo, G. Grilli di Cortona, *Dark Matter in Hidden Valley models with stable and unstable dark mesons*, **JHEP** **1904** (2019) **118**, arXiv:1809.10152 [hep-ph], **cited by 16**;
6. A. Belyaev, E. Bertuzzo, C. Caniu Barros, O. Eboli, G. Grilli di Cortona, F. Iocco, *Interplay of the LHC and non-LHC Dark Matter searches in the Effective Field Theory approach*, **Phys. Rev. D** **99** (2019) **no.1**, **015006**, arXiv:1807.03817 [hep-ph], **cited by 21**;
7. A. Falkowski, G. Grilli di Cortona, Z. Tabrizi, *Future DUNE constraints on EFT*, **JHEP** **1804** (2018) **101**, arXiv:1802.08296 [hep-ph], **cited by 18**;
8. H. Beauchesne, E. Bertuzzo, G. Grilli di Cortona, Z. Tabrizi, *Collider phenomenology of Hidden Valley mediators of spin 0 or 1/2 with semivisible jets*, arXiv:1712.07160 [hep-ph], **JHEP** **1808** (2018) **030**, **cited by 17**;
9. E. Bertuzzo, C. Caniu Barros, G. Grilli di Cortona, *MeV dark matter: model independent bounds*, **JHEP** **1709** (2017) **116**, arXiv:1705.06325 [hep-ph], **cited by 23**;
10. H. Beauchesne, E. Bertuzzo, G. Grilli di Cortona, *Constraints on the relaxion mechanism with strongly interacting vector-fermions*, **JHEP** **1708** (2017) **093**, arXiv:1705.06325 [hep-ph], **cited by 15**;
11. G. Grilli di Cortona, E. Hardy, J. Pardo Vega and G. Villadoro, *The QCD axion, precisely*, **JHEP** **1601** (2016) **034**, arXiv:1511.02867 [hep-ph], **cited by 312**;
12. G. Grilli di Cortona, *Hunting electroweakinos at future hadron colliders and direct detection experiments*, **JHEP** **1505** (2015) **035**, arXiv:1412.5952, **cited by 24**;

PART IX – OTHER RELEVANT INFORMATION

Other professional activities

Reviewer for Physical Review D and Physical Review Letters.

Outreach

- 2021 Collaborating with 'Reperto eventi e grafica, Servizio Informazione e Divulgazione Scientifica INFN - Laboratori Nazionali di Frascati' (Instagram posts on a glossary of physics).

Languages

ITALIAN: mother tongue
ENGLISH: fluent
GERMAN: basic knowledge - Zertifikat Deutsch (B1)
FRENCH: basic knowledge
RUSSIAN: basic knowledge

Computer Skills

Expert in Wolfram Mathematica (with the FeynArts, FormCalc, LoopTools, FeynRules and FeynCalc packages), C, C++, Fortran e Python (numpy, scipy, panda, multiprocessing, emcee, matplotlib, numericalunits, pyjags, keras, tensorflow, sklearn). Advanced knowledge of MadGraph, Pythia, Delphes, MadAnalysis, MCFM, FeynHiggs, DarkSusy and micrOMEGAs.

PART X – REFERENCES

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Frascati 20/4/2022

Luca Lepori

(19/04/2022)

PERSONAL INFO

---OMISSIS ---

PRESENT ACADEMIC POSITION

Since 01/02/2022: visiting researcher at QSTAR, INO-CNR and LENS, Firenze.
Advisor: prof. Augusto Smerzi.

PAST ACADEMIC POSITIONS

01/02/2020 - 31/01/2022: post-doc researcher at Università della Calabria, Cosenza. *Advisor:* prof. Domenico Giuliano.

15/09/2018 - 15/01/2020: post-doc researcher at Istituto Italiano di Tecnologia, Genova.
Advisor: prof. Marco Polini (Università di Pisa, Istituto Italiano di Tecnologia, and University of Manchester).

01/11/2016 - 31/08/2018 : post-doc researcher at Università dell' Aquila and Laboratori Nazionali del Gran Sasso (from 01/11/2017), L'Aquila, Italy. *Advisors:* prof. Simone Paganelli (Università dell'Aquila), prof. Massimo Mannarelli (Laboratori Nazionali del Gran Sasso).

01/06/2015 - 31/10/2016 : post-doc researcher at Università di Padova, Italy. *Advisors:* prof. Luca Salasnich, prof. Luca Dell'Anna.

01/03/2013 - 31/05/2015 : post-doc researcher at IPCMS-ISIS and Université de Strasbourg, France. *Advisor:* prof. Guido Pupillo.

01/01/2011 - 28/02/2013 : post-doc researcher at Universitat Autònoma de Barcelona, Spain, quantum information group. *Advisor:* prof. Anna Sanpera Trigueroes.

EDUCATION

Università di Pisa, Italy : *bachelor degree in physics*, obtained during the academic year 2003/2004 with a thesis titled: "An introduction to the electromagnetic field quantization".
Supervisor: prof. Enore Guadagnini.
Final mark: 110/110.

Università di Pisa, Italy : *master degree in theoretical physics*, obtained during the academic year 2004/2005 with a thesis titled: "Monopoles and exceptional groups".
Supervisor: prof. Adriano di Giacomo.
Final mark: 110/110 *cum laude*.

SISSA/ISAS, Trieste, Italy: *Ph.D. in statistical physics*.
Admitted via european competition with written and oral exams.
Beginning in October 2006 in the sector of elementary particle physics,
moving to the sector of statistical physics in october 2007.
Advisor: prof. Giuseppe Mussardo (SISSA).
Coadvisor: dr. Andrea Trombettoni (CNR-IOM Democritos and SISSA).
Final discussion on September 27th 2010.
Title of the PhD thesis: "QFT emerging models in condensed matter systems".
No final mark expected.
External referee: prof. German Sierra Roderio (Instituto de fisica teorica UAM-CSIC, Madrid).

MAIN RESEARCH INTERESTS (NOT MEANINGFUL ORDER)

- quantum simulations on cold atoms/condensed matter devices, with application both to condensed matter physics (unconventional superconductivity/superfluidity, topological phases of matter) and to high-energy physics (relativistic systems and QFT models, gauge fields dynamics included).
- methods and ideas from quantum computation applied to condensed matter physics and to quantum simulation on condensed matter devices. Entanglement (entanglement entropy, entanglement spectrum, multipartite entanglement) and its role in the study of phase transitions, unconventional phases of matter, and quantum simulation.
- physics of (multi-)Weyl and Dirac semimetals, topological and anomalous superfluid properties.
- low-dimensional physics, low dimensional field theories, integrable models, with applications to the study of quantum spin chains and generally of condensed matter systems.
- long-range interacting 1D and 2D quantum systems: effects from nonlocality, appearance of new phases, universality classes and topologies, breakdown of conformal symmetry, new entanglement properties.

MAIN ACHIEVED RESULTS (NOT MEANINGFUL ORDER)

For reference, see the next section "Publications and preprints"

- proposals for the realization of high-energy relevant phenomena in ultra-cold fermionic mixtures, including Weyl and Dirac fermions [6], symmetry-locking phases [14],[22], Majorana mass terms for spinors [30].
- simulation of symmetry-protected topological phases by ultra-cold atoms with gauge potentials, including 2D-3D Weyl semimetals [6],[11],[15] and multiple generalizations [18], 2D topological insulators [12].
- proposal of a general approach for the study of axial anomalies [34] and quantum transport [37] in semimetals.
- generalization of the abelian projection technique in QCD to exceptional Lie gauge groups [2]-[3],[5],[7].
- analysis of the scaling and the distribution for the entanglement spectrum close to quantum phase transitions [8],[10], multipartite entanglement [26][35][39].
- proposal of new quantifiers of multipartite entanglement [42].
- co-author of a C-program calculating the spectrum of the Wess-Zumino-Witten theories [9], directly exploiting the representations of the conformal group.
- study of ultra-cold atoms dynamics out of equilibrium: sounds [19], impurities in bosonic condensates [28], effectively unbalanced mixtures [33], many-flavour mixtures [14], [22], long-range coupled bosons [43].
- study of the spectrum induced by static potentials, abelian and nonabelian, on 2D and 3D lattices [25], [27].
- study of (1+1) conformal models with integrable and nonintegrable perturbations [1],[4].
- study of meson condensation, superfluidity, and locking via chiral perturbation theory [23],[36].
- long-range generalizations of the Kitaev chains and relations with the long-range Ising models; discover on them of new types of phases, universality classes, edge states [13],[16-17],[21],[24],[29], transport properties [32].
- study of the consequences of long-rangedness in quantum systems on locality properties, correlation functions, universality classes, CFT breakdown, non equilibrium properties, entanglement content [14],[16-17],[24],[26],[29], transport properties [32], multipartite entanglement [26].
- derivation of the infrared limit of long-range interacting systems [17],[21],[29].

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<http://iopscience.iop.org/article/10.1088/1126-6708/2008/10/096>
- [3] A. Di Giacomo, L. Lepori and F. Pucci (alphabetic order adopted for the list of authors), “’t Hooft tensor for generic gauge group”, published in *Nucl. Phys. Proc. Suppl.* **186** 231 (2009) [arXiv:0809.2154 [hep-lat]]. Prepared for the 14th High-Energy International Conference in Quantum Chromodynamics (QCD 08), Montpellier, France, 7-12th July 2008.
<https://www.sciencedirect.com/science/article/pii/S092056320800515X?via%3Dihub>
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<http://iopscience.iop.org/article/10.1088/1742-5468/2009/11/P11007/meta>
- [5] C. Bonati, A. Di Giacomo, L. Lepori, and F. Pucci (alphabetic order adopted for the list of authors), “Monopoles, abelian projection and gauge invariance”, *Phys. Rev. D.* **81**, 0805022 (2010).
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<http://iopscience.iop.org/article/10.1209/0295-5075/92/50003>
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<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.109.237208>
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<https://journals.aps.org/prb/abstract/10.1103/PhysRevB.87.235107>

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<http://iopscience.iop.org/article/10.1088/0953-4075/46/13/134014>
- [12] M. Burrello, I. C. Fulga, E. Alba, L. Lepori, and A. Trombettoni "Topological phase transitions driven by non-Abelian gauge potentials in optical square lattices", *Phys. Rev. A* **88**, 053619 (2013).
<https://journals.aps.org/prabstract/10.1103/PhysRevA.88.053619>
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<https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.113.156402>
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<http://iopscience.iop.org/article/10.1209/0295-5075/109/50002>
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<https://journals.aps.org/prb/abstract/10.1103/PhysRevB.94.085107>
- [16] D. Vodola*, L. Lepori*, E. Ercolessi, and G. Pupillo, "Long-range Ising and Kitaev Models: Phases, Correlations and Edge Modes", *New Journ. Phys.*, Volume **18**, (2016). Focus on Strongly interacting quantum gases in one dimension.
*: these authors contributed equally to the present paper.
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<http://iopscience.iop.org/article/10.1088/1751-8121/aa8d26/meta>
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<http://iopscience.iop.org/article/10.1088/1367-2630/aab1ae>
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- [34] L. Lepori, M. Burrello, and E. Guadagnini, ”Axial anomaly in multi-Weyl and triple-point semimetals”, *J. High En. Phys.* 2018: 110 (2018) .
[https://doi.org/10.1007/JHEP06\(2018\)110](https://doi.org/10.1007/JHEP06(2018)110)
- [35] M. Gabbriellini*, L. Lepori*, and L. Pezzé, ”Multipartite-Entanglement Tomography of a Quantum Simulator”, *New J. Phys.* **21** 033039 (2019).
<https://doi.org/10.1088/1367-2630/aafb8c>
*: these authors contributed equally to the present paper.
- [36] L. Lepori and M. Mannarelli, ”Multicomponent meson superfluids in chiral perturbation theory”, *Phys. Rev. D* **99**, 096011 (2019).
<https://journals.aps.org/prd/abstract/10.1103/PhysRevD.99.096011>
- [37] M. Burrello, E. Guadagnini, L. Lepori, and M. Mintchev (alphabetic order adopted for the list of authors), ”Field theory approach to the quantum transport in Weyl semimetals”, *Phys. Rev. B* **100**, 155131 (2019).
<https://doi.org/10.1103/PhysRevB.100.155131>
- [38] D. Giuliano, L. Lepori, and A. Nava, ”Tunable spin/charge Kondo effect at a double superconducting island connected to two spinless quantum wires”, *Phys. Rev. B* **101**, 195140 (2020).
<https://link.aps.org/doi/10.1103/PhysRevB.101.195140>
- [39] S. S. Mirkhalaf, E. Witkowska, and L. Lepori, ”Supersensitive quantum sensor based on criticality in an antiferromagnetic spinor condensate”, *Phys. Rev. A* **101**, 043609 (2020).
<https://journals.aps.org/pra/abstract/10.1103/PhysRevA.101.043609>
- [40] L. Lepori, S. Paganelli, F. Franchini, and A. Trombettoni, ”Mutual information for fermionic systems”, arXiv:2012.00045, submitted to *Phys. Rev. Res.* .
<https://arxiv.org/abs/2012.00045>
- [41] L. Lepori, A. Nava, D. Giuliano, and A. C. Perroni, ”Interplay between singlet and triplet pairings in multi-band oxide superconductors”, *Phys. Rev. B* **104**, 134509 (2021).
<https://journals.aps.org/prb/abstract/10.1103/PhysRevB.104.134509>
- [42] L. Lepori, A. Trombettoni, D. Giuliano, J. Kombe, J. Yago Malo, A. Daley, A. Smerzi, and M. L. Chiofalo, ”Characterizing multipartite entanglement through correlation functions”, arXiv:2108.03605, submitted to *Phys. Rev. Lett.* .
<https://arxiv.org/abs/2108.03605>
- [43] T. Macri, L. Lepori, G. Pagano, M. Lewenstein, and L. Barbiero, ”Bound state dynamics in the long-range XXZ model”, *Phys. Rev. B* **104**, 214309 (2021).
<https://journals.aps.org/prb/abstract/10.1103/PhysRevB.104.214309> .

- [44] A. Nava, D. Giuliano, L. Lepori, and M. Rossi, *Out of equilibrium charge transport in molecular electronic devices*, prepared for "SCES2020: international conference on strongly correlated electron systems", September 27th - October 2nd 2021, Brazil. J. Phys.: Conf. Ser. 2164 012051 (2022).
<https://sces2020.org/proceeding/>
- [45] L. Pezzé and L. Lepori, *Robust multipartite entanglement in dirty topological wires*, arXiv:2204.02209, submitted to Sci. Post.
<https://arxiv.org/abs/2204.02209>

OTHER PROCEEDINGS OF CONFERENCES AND CITED PREPRINTS

- [P1] A. Di Giacomo, L. Lepori, and F. Pucci, *Homotopy, monopoles and 't Hooft tensor for generic $gau(u)$ groups*, arXiv:0808.4041. Not published (become paper [2] of the previous Section) but cited (5 times on arXiv at 13/04/2021).
<https://arxiv.org/abs/0808.4041>
- [P2] A. Di Giacomo, L. Lepori and F. Pucci, *'t Hooft tensor for generic gauge group*, arXiv:0809.4563. Prepared for the 34th International Conference of High Energy Physics 2008, Philadelphia.
<https://arxiv.org/abs/0809.4563>

IN CLOSE SUBMISSION (APPEARANCE EXPECTED AT MOST BY MAY 2022)

- L. Lepori, A. Trombettoni, and A. Smerzi, "Onsager-Penrose criterion and quantum Fisher information in Bose-Einstein condensates".
- L. Lepori, M. Burrello, A. Trombettoni, and S. Paganelli, "Scaling of optimal strange correlators and Onsager-Penrose criterion for topological quantum systems".

BIBLIOMETRIC INDICES, TO DATE 19/04/2022

ISI Web of Knowledge (via Publons, to be updated)

- Published papers (since 2008): 40
- Total citations (since 2008): 851
- H-index (since 2008): 16
- average citations per article (since 2008): 21.23

Google Scholar

- Published papers and preprints (since 2008): 45+3
- Total citations (since 2008): 1226 ; (since 2017): 940
- H-index (since 2008): 19 ; (since 2017): 15
- i-10 index (since 2008): 26 ; (since 2017): 21

GIVEN TALKS IN CONFERENCES AND SCHOOLS

- Speaker at the conference "Quantum coherence and correlation in condensed-matter and cold-atoms systems", Evora, Portugal, 11th - 15th October 2010. Short talk: "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices".
- Invited speaker at the workshop "Quantum Information and Quantum Phenomena Pyrenees Meeting 2013" (2nd edition), Espot, Lleida (Spain), 18-20th February 2013. "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Invited speaker at the Spring College of Complex Systems, ICTP, Trieste, 22th May 2013: "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Invited speaker at Winter Workshop on Ultracold Quantum Matter, Padova, 11th January 2016: "Ultra-cold atoms as universal quantum simulators: symmetry-locked superfluid phases".
- Invited speaker at "From Static to Dynamical Gauge Fields with Ultracold Atoms", Galileo Galilei Institute for Theoretical Physics, Firenze, 22th May - 23th June 2017: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Speaker at the conference "FisMat 2017", ICTP-SISSA Miramare Campus, Trieste, October 1-5th 2017: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Invited speaker at the conference "Quantum Path", Erwin Schrödinger International Institute for Mathematics and Physics, Wien, May 30th 2018: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Speaker at the 105th conference of the Società Italiana di Fisica, Gran Sasso Science Institute, L'Aquila, September 23-27th 2019: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Speaker at the conference "Quantum gases, fundamental interactions and cosmology-Second Edition (QFC 2019)", Pisa, October 23-25th 2019: "Synthesis of Majorana mass terms in low-energy quantum systems".
- Speaker at the conference "SM and FT 2019 - The XVIII Workshop on Statistical Mechanics and nonperturbative Field Theory", Bari, December 11-13th 2019: "Abelian axial anomalies in 3D semimetals".

- Invited speaker to the "Online Workshop on Quantum Information Science", Teheran 1th - 2nd February 2022, School of Nano Science, Institute for Research in Fundamental Sciences (IPM), Tehran, Iran: "Characterizing multipartite entanglement through correlation functions".

GIVEN SEMINARS IN UNIVERSITIES AND RESEARCH CENTERS

- Speaker at SISSA, March 2009: "Colour confinement: ideas and methods from statistical physics", based on my research in collaboration with the lattice gauge group of Università di Pisa.
- Invited speaker at LAPHY Annecy (France), 8th April 2010: "Simulation of (3+1) Dirac fermions by ultracold atoms in optical lattices".
- Speaker at joint ICTP-SISSA Statistical Physics seminar, Trieste, May 25th 2010: "Simulation of massive (3+1) Dirac fermions by ultracold atoms in optical lattices".
- Invited speaker at Max-Planck Institut für Quantenoptik, Garching (Germany), 27th July 2010: "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices".
- Invited speaker at Università della Calabria, Cosenza (Italy), 18th November 2010: "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices".
- Invited speaker at Universidad Complutense de Madrid, 25th November 2010: "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices".
- Speaker at Universitat Autònoma de Barcelona, 5th May 2011: "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices".
- Invited speaker at Universitat de Barcelona, 3rd July 2012: "New fun with QFT by ultra-cold atoms on optical lattices".
- Speaker at Universitat Autònoma de Barcelona, 24th July 2012: "New fun with QFT by ultra-cold atoms on optical lattices".
- Invited speaker at Instituto de Física Teórica UAM/CSIC, Universidad Autònoma de Madrid, 22-th October 2012: "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Invited speaker at Institute for Quantum Optics and Quantum Information, Innsbruck, 8th November 2012: "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Invited speaker at Lens, Firenze, 27th June - 28th June 2013: "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Invited speaker at Università di Trento-BEC, Trento, 19th February 2014: "Long-range interacting Kitaev chains".
- Invited speaker at INRIM, Torino, 30th September 2014: "Long-range interacting Kitaev chains".

- Invited speaker at Scuola Normale Superiore, Pisa, 24th October 2014: "Long-range interacting Kitaev chains".
- Invited speaker at Gran Sasso Laboratories, L'Aquila, Italy, 17th February 2015: "Ultra-cold atoms as universal quantum simulators: symmetry-locked superfluid phases".
- Invited speaker at Università della Calabria, Cosenza (Italy), 9th June 2015: "Long-range interacting Kitaev chains".
- Invited speaker at Università della Calabria, Cosenza (Italy), 11th June 2015: "Ultra-cold atoms as universal quantum simulators: symmetry-locked superfluid phases".
- Speaker at Università di Padova, 4th November 2015: "Two key examples of long-range quantum chains".
- Invited speaker at Gran Sasso Laboratories, L'Aquila, Italy, 18th December 2015: "Unexpected effects in long-range quantum models".
- Invited speaker at Politecnico Torino, Dipartimento di Scienza Applicata e Tecnologia, 17th March 2016: "Unexpected effects in long-range quantum models".
- Invited speaker at Università di Pisa, Dipartimento di Fisica, 5th May 2016: "Unexpected effects in long-range quantum models".
- Invited speaker at Università della Calabria, Cosenza (Italy), 30th June 2016: "Multi-Weyl semi-metals in synthetic gauge potentials".
- Invited speaker at Università dell'Aquila, L'Aquila (Italy), 7th December 2016: "An introduction to ultra-cold atoms". Tutorial, also for master and PhD students.
- Invited speaker at Università di Camerino, Camerino (Italy), 28th September 2017: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Speaker at Università dell'Aquila, L'Aquila (Italy), 9th October 2017: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Invited speaker at Universidad Complutense de Madrid, 10th July 2018: "Emergence of elementary particle phenomena on semimetals".
- Invited speaker at Università della Calabria, Cosenza (Italy), 11th September 2018: "Dirac and (multi-)Weyl semimetals: condensed matter physics meets particle physics".
- Invited speaker at Università dell'Aquila, L'Aquila (Italy), 10th October 2018: "Dirac and (multi-)Weyl semimetals: condensed matter physics meets particle physics".
- Speaker (internal) at Scuola Normale Superiore, Pisa, 7th November 2018: "Emergent Majorana mass terms in condensed matter devices".
- Invited speaker at Università di Napoli, 12th December 2018: "Dirac and (multi-)Weyl semimetals: condensed matter physics meets particle physics".
- Invited speaker at Università della Calabria, Cosenza (Italy), 10th July 2019: "Emergent axion quasiparticles in condensed matter systems".

- Invited speaker at Università dell'Aquila, L'Aquila (Italy), 11th September 2019: "Emergent axion quasiparticles in condensed matter systems".
- Speaker (internal) at Scuola Normale Superiore, Pisa, 27th November 2019: "Abelian axial anomalies in multi-Weyl and triple-point semimetals".
- Invited speaker at Ecole Normale Supérieure de Lyon, 30th January 2020: "Abelian axial anomalies in multi-Weyl and triple-point semimetals".
- Invited online speaker to International Institute of Physics, Natal (Brasil), 10th September 2020: "Long-range topological insulators and weakened bulk-boundary correspondence".
- Invited online speaker to Heinrich-Heine-Universität, Düsseldorf (Germany), 10th June 2021: "Abelian axial anomalies in multi-Weyl and triple-point semimetals".
- Invited speaker to Niels Bohr Institute, Copenhagen, 15th December 2021: "Characterizing multipartite entanglement through correlation functions".
- Speaker at the online meeting "TOP-SPIN Project Meeting", 1th February 2022: "Interplay between singlet and triplet pairings in multi-band oxide superconductors".

POSTER PRESENTATIONS IN CONFERENCES AND SCHOOLS

- "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices", poster session at "New frontiers in graphene physics" conference, ECT* European Center for Theoretical Studies in Nuclear Physics and Related Areas, Trento, 12-14th April 2010.
- "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices", poster session at "Quantum coherence and correlation in condensed-matter and cold-atoms systems", Evora, Portugal, 11th-15th October 2010.
- "Simulation of (3+1) Dirac fermions with ultracold atoms in optical lattices", poster session at "Quantum coherence and correlation in condensed-matter and cold-atoms systems", Workshop "Quantum Simulation", Benasque, Spain, 28th February - 5th March 2011.
- "Scaling of the entanglement spectrum in the vicinity of the Haldane phase", poster session at the workshop "Quantum Optical Information Technology", Barcelona 5-7th October 2011.
- "Scaling of the entanglement spectrum in the vicinity of a critical point", poster session at the workshop "Topological states of matter", Freiburg 18-22th March 2012.
- "Fractional Vortices with Non-Abelian Modes in Ultracold Color-flavor Locked Phases", poster session at the workshop "Ultracold Atoms and Gauge Theories", International Center for Theoretical Physics, Trieste, 13-17th May 2013.
- "Long-range interacting Kitaev chains", poster session at the conferences "Progresses in quantum information and quantum simulation", Lyon, 17-19th November 2014.

- "Dynamics of Rabi-coupled and interacting two-components Fermi gas", poster session at the workshop "Frontiers in ultracold Fermi gases - 90 years after the "birth" of fermions in Florence", Galileo Galilei Institute, Firenze, 21-23th March 2016.

DIDACTIC ACTIVITY

- Tutor for Master Thesis: A. Maraga, "Study of Rabi and Josephson coupled ultracold Fermi systems", Università di Trento and SISSA/ISAS (Trieste), academic year 2011/2012. Advisor: Prof. Andrea Trombettoni, CNR-IOM Democritos and SISSA, Trieste.
- Tutor for Master Thesis: G. Mazzucchi, "BCS-BEC crossover on layered Fermi-Hubbard model with Dirac points", Università di Trento and SISSA/ISAS (Trieste), academic year 2011/2012. Advisor: Prof. Andrea Trombettoni, CNR-IOM Democritos and SISSA, Trieste.
- Tutor for Ph.D. thesis: D. Vodola, "Correlations and Quantum Dynamics of 1D Fermionic Models: New Results for the Kitaev Chain with Long-Range Pairing", Università di Bologna and ISIS-IPCMS, Université de Strasbourg, academic years 2012/2015. Advisors: Prof. Elisa Ercolessi (Univ. Bologna) and Prof. Guido Pupillo (Univ. Strasbourg).
- Tutor for Ph.D. thesis: Joao Pinto Barros, "Field and Gauge Theories with Ultracold Atoms", SISSA (Trieste), academic years 2013/2017. Advisors: Prof. Andrea Trombettoni (CNR-IOM Democritos and SISSA), and Doc. Marcello Dalmonte (ICTP and SISSA, Trieste).
- Tutorial, also for master and PhD students, at Universitat Autònoma de Barcelona, Spain, July 2012: "Fun with ultracold atoms: an introduction to the quantum simulation of high-energy physics".
- Invited speaker at the Spring College of Complex Systems, ICTP, Trieste, 22th May 2013: "CFL locked phases and non abelian fractional vortices by ultracold atoms in optical lattices".
- Tutorial, also for master and PhD students, at Università dell'Aquila, L'Aquila (Italy), 7th December 2016: "An introduction to ultra-cold atoms".
- Tutorial, also for master and PhD students, at QSTAR, Firenze, March 2017: "Symmetry-protected topological matter".
- Trainer for Physics Olympiad, Italian national selection 2018, of the team from Abruzzo (Italian region).
- Course "Quantum mechanics 2", Università della Calabria, academic year 2020/2021. Teaching assistant.
- Co-relator for bachelor degree of the student Mattia Rudi. Title of the thesis: "Axion dynamics at the surfaces of strong topological insulators". First relator: prof. Domenico Giuliano. Università della Calabria, academic year 2020/2021.

- Teaching assistant and examiner for the course "General physics with elements of mathematics", concerning the bachelor degrees in "pharmacy" (first semester) and in "chemical and pharmaceutical technologies" (second semester), Università di Pisa, academic year 2020/2021.
- Course "Quantum Field Theory A", for the 4th year of the master degree in (theoretical) physics, Università della Calabria, academic year 2020/2021. Teaching assistant and examiner.
- Teaching assistant and examiner for the course "General physics with elements of mathematics", concerning the bachelor degrees in "pharmacy" (first semester), Università di Pisa, academic year 2021/2022.

PARTICIPATION TO RESEARCH PROJECTS

- PROJECT TITLE: INSTANS
FINANCIAL ENTITY: EUROPEAN SCIENCE FOUNDATION
DURATION: FROM: OCTOBER 2005, TO: OCTOBER 2010.
PRINCIPAL INVESTIGATOR: Giuseppe Mussardo (SISSA, Trieste).
DESCRIPTION: on the webpage <https://people.sissa.it/~mussardo/>
- PROJECT TITLE: PI12.
FINANCIAL ENTITY: INFN, Italy.
DURATION: FROM: 2006, TO: 2010, included.
PRINCIPAL INVESTIGATOR: Adriano Di Giacomo (univ. Pisa and INFN).
DESCRIPTION (taken from the web): Confinement of color and deconfining transition in QCD. Focus on the effective mechanism of "dual superconductivity" of the QCD vacuum.
- PROJECT TITLE: MINECO (FIS2008- 01236)
FINANCIAL ENTITY: European Regional development Fund.
DESCRIPTION: Generalitat de Catalunya Grant No. SGR2009-00347.
- PROJECT TITLE: 2012 ERC Starting Grant
FINANCIAL ENTITY: EUROPEAN SCIENCE FOUNDATION.
DURATION: FROM: 2013, TO: 2018, included.
PRINCIPAL INVESTIGATOR: Guido Pupillo (ISIS and IPCMS, Strasbourg), winner of the grant.
- PROJECT TITLE: NEUMATT
FINANCIAL ENTITY: INFN, Italy.
LENGHT: still running.
PRINCIPAL INVESTIGATOR: Alessandro Drago (univ. Ferrara).
DESCRIPTION: at the webpage
<https://web.infn.it/CSN4/IS/Linea5/NEUMATT/NEUMATT.html>.
- PROJECT TITLE: GRAPHENE FLAGSHIP
FINANCIAL ENTITY: EUROPEAN SCIENCE FOUNDATION.
DESCRIPTION: at the webpage <https://graphene-flagship.eu/>.

- PROJECT TITLE: PRIN project 2017 number 20177SL7HC
 FINANCIAL ENTITY: Italian ministry of education and research, Italy.
 DURATION: FROM: 2019, TO: 2022, included.
 PRINCIPAL INVESTIGATOR: Marco Salluzzo (CNR, Napoli).
 DESCRIPTION: at the webpage <https://www.spin.cnr.it/images/TOPSPIN.pdf>

COLLABORATION WITH SPECIALIZED REVIEWS

Referee for Physical Review A/B/D/E, Physical Review Letters, Journal of Condensed Matter, Journal of Physics A, Scientific Reports, International Journal of Modern Physics, and Nature Communications.

COMPUTER SKILLS

Good knowledge of FORTRAN, C, C++, Python, MATLAB, Mathematica, Kwant packages for simulations of transport in nanostructures.

SPOKEN LANGUAGES

- Italian, mother tongue.
- English, fluent.
- French, basic level.
- Spanish, basic level.

PUBLIC OUTREACH

- Organizer of the "Notte dei Ricercatori", Trieste, September 24th 2010, in the group "Ricercatori Erranti".
 Co-author of the public document "Il futuro della ricerca" (The future of research).
- Trainer for Physics Olympiad, Italian national selection 2018, of the team from Abruzzo (Italian region).

FUNDING AND HONOURS

- January 2011: fellowship (3-6 years) of the FCT Fundacao Para a Ciencia e a Tecnologia, Ministerio da Ciencia, Tecnologia e Ensino Superior, Portugal. Amount of the grant per year: 19.000 euro (nets). *Renounced.*
- November 2012: fellowship from the Angelo Della Riccia foundation, Florence (Italy). Fellowship for Italian young researchers willing to make investigation in a foreign country. Elected research center: Universitat Autònoma de Barcelona, Group of Quantum Information and Quantum Phenomena, Barcelona, Spain. Total amount of the grant: 13.500 euro. *Renounced.*

- February 2019: co-writer and external recipient of the PRIN project 2017 number 20177SL7HC, financed by the Italian Ministry of education and research.
- Title "Expert in Physics" (eligibility as examiner for academic courses in physics), Università di Pisa, Department of Pharmacy, academic years 2020/2021 and 2021/2022.

ITALIAN MINISTERIAL LICENSES

- Italian ministerial eligibility for associate professor of condensed matter theory (FIS-02/B2), from 03/04/2018 to 03/04/2027.
- Italian ministerial eligibility for associate professor of theory of fundamental interactions (FIS-02/A2), from 13/07/2018 to 13/07/2027.
- Italian ministerial eligibility for full professor of condensed matter theory (FIS-02/B2), from 27/01/2022 to 27/01/2031.

FRENCH MINISTERIAL LICENSES

- French ministerial eligibility for "maitre de conférence" (comparable to associate professor) of condensed matter theory (28 - milieux denses et matériaux), from 26/02/2020.

ACADEMIC REFERENCES (ALPHABETICAL ORDER)

Maria Luisa Chiofalo

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Adriano Di Giacomo

Emeritus professor of theoretical physics
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Domenico Giuliano

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Alexey V. Gorshkov

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Simone Paganelli

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German Sierra Rodero

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Augusto Smerzi

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Andrea Trombettoni

Tenured professor,
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Strada Costiera 11, I-34151 Trieste, Italy
CNR-IOM Democritos and SISSA, Trieste
Via Bonomea 265, 34151 Trieste, Italy
tel. +39 040 2240 260
e-mail: atrombettoni@units.it; andreatr@sissa.it

Europass Curriculum Vitae

Summary:

- He is currently working at the University of Pisa, Mathematics Department, as Postdoctoral Researcher and at the University of Camerino, Physics Division, as Adjunct Professor (professore a contratto) for the master's courses in: Theoretical Physics, Quantum Field Theory and Cosmology. Before these employments, he worked as Assistant Professor (Ricercatore a tempo determinato, III livello) at the National Institute of Nuclear Physics (INFN) in Frascati, in the *Satellite/lunar/GNSS laser ranging/altimetry and cube/microsat Characterization Facilities Laboratory - SCF Lab*, as theorist and product assurance manager for the MoonLIGHT and LARES2 experiments.
- He got cum laude his master degree in Physics at the University of Naples "Federico II" in 2008. He gained the international PhD degree in Relativistic Astrophysics at the University of Rome "La Sapienza" in 2012. In 2015 he obtained a second bachelor in Civil Engineering at the "Pegaso" University in Naples. During his PhD program and later, he spent several periods in abroad universities, e.g. the UNAM university in Mexico, Cape Town University in South Africa, Al-Faraby University in Kazakhstan, etc. Moreover, immediately after the PhD, he was research fellow in the European KM3NeT Project for neutrino search during the period 2013-2015, attending specialist courses in Astroparticle Physics and Management at the INFN, South National Laboratories (LNS), Catania.
- In 2021 he received the National Scientific Qualification as Full Professor, (art.16 of the law 30 December 2010, n.240, Settore Concorsuale:02/A2 - Fisica Teorica delle Interazioni Fondamentali, SSD FIS/02 - Fisica Teorica, Modelli e Metodi Matematici). Before this qualification, in 2018, he also was awarded with the Scientific Qualification as Associate Professor, in the same field, namely theoretical physics. In addition, in 2021, he was also awarded as Outstanding international referee of the year 2020 from the World Scientific, Modern Physics Letters A, for highly-qualified reviews. In 2015, he was awarded the Polvani national prize, from the Italian Society of Physics (SIF), for his high-impact researches within the period 2008-2015.
- Currently he is Adjunct Professor of Theoretical Physics, Quantum Field Theory and Cosmology at the University of Camerino. Before this, he was Teaching Assistant for: Astroparticle Physics, Cosmology and General Physics at the University of Naples "Federico II", and for Mathematical Methods for Physics at the University of Camerino and at the University of Naples "Federico II". Moreover, he has taught General Physics and Calculus for bachelors in: Civil, Energetic, Electronic and Computational Engineerings, at the University of Benevento, with Co. Co. Co. teaching contracts.
- He was and is regularly present in several local and international meetings. He was chairman for parallel sessions of the Marcel Grossmann meeting for the 2018 and 2021 editions. He is editor for: International Journal for Geometric Methods in Modern Physics, World Scientific, for Galaxies, MDPI, and for the Italian publisher Licosia Edizioni, and also guest editor for various special issues in several journals.
- He is author of more than 110 scientific contributions, including research papers, chapters of books, proceedings, etc. His research activity is based on many collaborations with young and senior researchers. His interests mainly focus on theoretical physics, cosmology, quantum information and thermodynamics.

Personal information

Surname / First name

Address

Telephone

Personal Email

Nationality

Date of birth

Gender

Occupational field

Luongo, Orlando

(Work): Largo Bruno Pontecorvo, 5, Pisa, Italy

+39 050 22 13 274 Mobile: +OMISSIS

orlando.luongo@dm.unipi.it, orlando.luongo@unicam.it

Italian

02-11-1984 - Current age: 37

Male

Postdoctoral Researcher in theoretical physics

EDUCATION

—Dates

Occupation or position held

Main activities and
responsibilities

Name and address of employer

With thesis

Supervisor

Coordinator

Final vote

03/11/2008 – 29/03/2012

International PhD in Relativistic Astrophysics at ICRANet, VII cycle IRAP (Physics, XXIV cycle at UniRoma1)

Research in general relativity and theoretical cosmology

University of Rome "La Sapienza", Italy and ICRANet

Geometrothermodynamics in general relativity as a tool to describe the Universe dynamics

Prof. Hernando Quevedo

Prof. Remo Ruffini, Prof. Roy Patrick Kerr

Excellent/Excellent

—Dates

Title of qualification awarded

Principal subjects

Name and type of organization
providing education and
training

With thesis

Supervisors

Average grade

Final vote

01/10/2006 – 16/07/2008

Master's Degree in Physics

Theoretical Physics

University of Naples "Federico II"

L'approccio tomografico in Cosmologia Quantistica

Prof. Salvatore Capozziello, Dr. Cosimo Stornaiolo

30/30

110/110 cum laude

—Dates

Title of qualification awarded

Principal subjects

Name and type of organization
providing education and
training

With thesis

Supervisor

Average grade

Final vote

01/10/2003 – 14/09/2006

Bachelor's Degree in Physics

Theoretical Physics

University of Salerno

Fenomeni di coerenza in processi di interazione tra radiazione e materia

Prof. Fabrizio Illuminati

30/30

110/110 cum laude

_____—Dates	06/12/2014 – 29/09/2015
Title of qualification awarded	Bachelor's Degree in Civil Engineering
Principal subjects	Civil Engineering
Name and type of organization providing education and training	University of Naples " <i>Pegaso</i> "
With thesis	Studio quantitativo delle facciate ventilate per il miglioramento dell'efficienza termica degli edifici
Supervisor	Prof.ssa Paola Iodice
Average grade	27/30
Final vote	105/110

_____—Dates	15/09/98 - 07/07/2003
Title of qualification awarded	Scientific high school diploma
Name and type of organization providing education and training	Liceo Scientifico "Leonardo Da Vinci", Salerno
Final vote	100/100

WORK EXPERIENCES

_____—Dates	02/11/2020 - present
Occupation or position held	Postdoctoral Researcher (Assegnista di Ricerca)
Title of the fellowship	<i>Test di teorie della gravitazione con esperimenti di radioscienza</i>
Main activities and responsibilities	Research in gravitational and theoretical physics.
Name and address of employer	University of Pisa, Mathematics Department, Pisa, Italy.
Supervisor	Prof. Giacomo Tommei

_____—Dates	09/10/2017 – 08/09/2020
Occupation or position held	Assistant Professor (Ricercatore INFN di III livello a tempo determinato - Articolo 36)
Main activities and responsibilities	Research in space optics, Lunar Laser Ranging techniques and cosmology.
Name and address of employer	National Institute of Nuclear Physics (INFN), Frascati, Italy.
Coordinator	Dr. Simone Dell'Agnello

_____—Dates	14/03/2022 – present
Occupation or position held	Research Associate as Foreign Adjunct Professor
Main activities and responsibilities	Research on quantum field theory effects applied to cosmology and to gravitational physics.
Name and address of employer	Institute of Fundamental and Applied Research, National Research University "TI-IAME", Tashkent, Uzbekistan.

Coordinator	Prof. Bobomurat Ahmedov
—Dates	06/01/2020 – present
Occupation or position held	Leading Research Associate
Title of the fellowship	<i>Astrophysical implications of white dwarf stars</i> , IRN: AP08052311
Main activities and responsibilities	Research on dark matter physics and on compact objects.
Name and address of employer	Al-Farabi Kazakh National University, Almaty, Kazakhstan.
Coordinator	Prof. Kuantay Boshkayev
—Dates	01/03/2018 – present
Occupation or position held	Adjunct Professor
Main activities and responsibilities	Professor of Quantum Field Theory (since 2017/2018), Cosmology (since 2019/2020) and Theoretical Physics (since 2021/2022)
Name and address of employer	School of Science and Technology, University of Camerino, Camerino, Italy.
—Dates	01/01/2018 – 31/12/2020
Occupation or position held	Leading Research Associate
Title of the fellowship	<i>Fundamental and applied studies in related fields of physics of terrestrial, near-Earth and atmospheric processes and their practical application</i> , IRN: BR05236494
Main activities and responsibilities	Research on dark matter physics and on compact objects.
Name and address of employer	Al-Farabi Kazakh National University, Almaty, Kazakhstan.
Coordinator	Prof. Kuantay Boshkayev
—Dates	01/03/2017 – 30/09/2017
Occupation or position held	Research fellowship (Borsista di Ricerca)
Title of the fellowship	<i>Relativistic Quantum Information Theory</i>
Main activities and responsibilities	Research in Quantum Information and applications to cosmology.
Name and address of employer	School of Science and Technology, University of Camerino, Camerino, Italy.
Supervisor	Prof. Stefano Mancini
Coordinator	Prof. Stefano Mancini
—Dates	01/01/2017 - 28/02/2017
Occupation or position held	Research fellowship (Borsista di Ricerca)
Title of the fellowship	<i>Modelli fisici per l'interazione radiazione-materia</i>
Main activities and responsibilities	Research for the European Project MaXIMA CUP:E62I16000010006.
Name and address of employer	Department of Physics "E. Pancini", University of Naples, Naples, Italy.
Supervisor	Prof. Fedele Lizzi
—Dates	01/01/2016 – 31/12/2016
Occupation or position held	Postdoctoral Researcher
Title of the fellowship	<i>Fisica Teorica</i>

Main activities and responsibilities	Research in Theoretical Physics.
Name and address of employer	Department of Physics "E. Pancini", University of Naples, Naples, Italy.
Supervisor	Prof. Fedele Lizzi
_____Dates	01/07/2015 – 31/12/2015
Occupation or position held	Postdoctoral Fellowship
Title of the fellowship	<i>Cosmographic reconstructions of Dark Energy in Alternative Theories of Gravity</i>
Main activities and responsibilities	Research on Cosmography and on the dynamics of dark energy at late and early times.
Name and address of employer	Department of Mathematics and Applied Mathematics, University of Cape Town, Cape Town, South Africa.
Supervisor	Prof. Peter Dunsby
Co-Supervisor	Dr. Alvaro de la Cruz-Dombriz
Coordinator	Prof. Peter Dunsby
_____Dates	15/03/2013 – 14/03/2015
Occupation or position held	Research fellowship (Borsista di Ricerca) for the Km3NeT project
Title of the fellowship	<i>Una nuova frontiera per la ricerca: Gli osservatori sottomarini</i>
Main activities and responsibilities	Research in Astroparticle Physics and Cosmology with particular attention to neutrino physics.
Name and address of employer	National South Laboratories (LNS) of National Institute of Nuclear Physics (INFN), Catania, Italy.
Supervisor	Dr. Pasquale Migliozzi
Coordinator	Dr. Rosa Coniglione
_____Dates	01/07/2012 – 31/10/2012
Occupation or position held	Research Associate
Post-doc title	<i>Geometrothermodynamics</i>
Main activities and responsibilities	Research in geometrical aspects of Universe's thermodynamics.
Name and address of employer	Institute for Nuclear Science (ICN), Universidad National Autonoma de Mexico, (UNAM), Mexico City, Mexico.
Supervisor	Prof. Hernando Quevedo
Coordinator	Prof. Hernando Quevedo

ACHIEVEMENTS

National Qualifications:

1. National Scientific Qualification (abilitazione scientifica nazionale) as Full Professor (**professore ordinario**),

art.16 of the law 30 December 2010, n.240, Settore Concorsuale: 02/A2 - Fisica Teorica delle Interazioni Fondamentali, Settore Scientifico Disciplinare: FIS/02 - Fisica Teorica, Modelli e Metodi Matematici).

Dates covered: 14/04/2021 - 14/04/2030

2. National Scientific Qualification (abilitazione scientifica nazionale) as Associate Professor (**professore associato**),

art.16 of the law 30 December 2010, n.240, Settore Concorsuale: 02/A2 - Fisica Teorica delle Interazioni Fondamentali, Settore Scientifico Disciplinare: FIS/02 - Fisica Teorica, Modelli e Metodi Matematici).

Dates covered: 13/07/2018 - 13/07/2027

3. Italian qualification, "Tirocinio Formativo Attivo", TFA, at the University of Salerno, Italy, with final vote 100/100.

Date: 29/07/2013

International awards and honors:

1. Awarded as Outstanding Referee 2020 by World Scientific for the international journal: *Modern Physics Letter A*, (2021).
2. Awarded by Universidade Federal de Campina Grande, UFCG, as Visiting Lecturer (Professor Visitante Estrangeiro) in Cosmology, Brazil, (2020).
3. Awarded by "Highlights of 2014" of International Journal of Modern Physics D for the work: *A unified dark energy model from a vanishing speed of sound with emergent cosmological constant*, in collaboration with prof. Hernando Quevedo, Co-Author of the work, (2014).
4. Present on Wikipedia: *en.wikipedia.org/wiki/Cosmological_constant_problem* in the section dealing with the most consolidate proposed solutions of the cosmological constant problem.
5. Present on Wikipedia: *en.wikipedia.org/wiki/Kerr%E2%80%93Newman_metric* as a reference for the geodesic equations.
6. Present on Wikipedia: *en.wikipedia.org/wiki/Cosmography* concerning the development of new cosmographic methods with parameterized redshift variables.
7. Present on Wikipedia: *en.wikipedia.org/wiki/Anton%E2%80%93Schmidt_equation_of_state* concerning the applications of the Anton-Schmidt equation of state in cosmology.

National awards and honors:

1. Awarded by "Società Italiana di Fisica" (SIF) with Giovanni Polvani Prize for scientific industriousness merits during the period May 2008 - May 2015, Rome, Italy, (2015).
2. Awarded for *Progetto di Formazione Specialistica: Una Nuova Frontiera per la Ricerca: Gli Osservatori Sottomarini*, considered as a Master diploma in Physics, Catania, Laboratori Nazionali del Sud (INFN-LNS), Italy, (2015).
3. Prize: *Premio De Simone Per l'impegno sociale 2016* gained for relevant results in the field of Cosmology, Montoro (AV), (2016).
4. Prize: *Merits in Astrophysics 2015* gained from Comune di Montoro, for high-impact researches in the field of Astrophysics and Cosmology, Montoro (AV), Italy, (2015).
5. Prize awarded for "high-impact science communication" gained from *Percorsi culturali di eccellenza: Sapere Aude*, by Istituto di Istruzione Superiore "Leonardo Da Vinci", Salerno, Italy, (2013).
6. Finalist in Regional Selection for *Giochi della Chimica*, Naples, Italy, (2002).

Honorable interviews:

1. Interview proposed by Mr. Stephen Battersby for New Scientist, awarded for the work: *Dark energy from entanglement entropy*, developed by Prof. Salvatore Capozziello, (Co-Author of the work), (2013).
2. Interview proposed by the Journal Contattolab, awarded for merits in Astrophysics, (2015). (Link: <http://www.contattolab.it/orlando-luongo-scientiato-montorese-premiato-come-miglior-ricercatore/>).
3. Interview proposed by the Journal Tuttolocal, awarded for merits in Astrophysics, (2015). (Link: <http://www.tuttolocal.it/home/astrofisica-cosmologia-relativistica-metriche-dello-spazio-tempo-premiato-le-ricerche-di-orlando-longo-straordinario-scientiato-montorese/>).
4. Interview proposed by the TV channel Telespazio for the scientific results got during the period 2009-2021, (2021).

Personal skills and competences

Mother tongue

Other language(s)

*Self-assessment
European level^(*)*

English

Spanish

French

Italian

Understanding		Speaking		Writing
Listening	Reading	Spoken interaction	Spoken production	
C2	C2	C2	C2	C2
C1	C2	C1	B2	B2
B2	B2	B1	B1	A2

^(*) Common European Framework of Reference (CEF) level

Language diplomas:

1. Trinity College Certificate (English, Level 9/Level B2.3), Salerno, (2002).
2. Aspect International Language Academies, (English, Level B2), London, (2002).
3. PET certificate, (English, Level B2), Cambridge, (2008).

Computer driving licences:

1. E.C.D.L. Professional C.A.D. (European Computer Driving License), 3rd level.
2. E.C.D.L. Advanced (European Computer Driving License), 2nd level.
3. E.C.D.L. Core (European Computer Driving License), 1st level.

Computer skills and competence in programming:

Excellent competences in:

1. Windows (All versions and packages), Linux (All versions and packages), MAC-OS (All versions and packages),
2. Web site realizations and maintenance,
3. Numerical calculus and programming: Wolfram Mathematica (All versions), Maple, MATLAB,
4. CosmoMC, CAMB,
5. Iraf, SuperMongo,
6. Python, R, C/C++, Fortran,
7. Office (All versions),
8. GNU PLOT, Origin,
9. LateX, Root, BAT,
10. AutoCAD, BIM,
11. Code V, Planetary Ephemeris Program-PEP.

Masters and Specialisations:

1. Specialisation course in: *Space Optics* obtained at the European Space Research Technology Centre (ESTEC), Noordwijk, the Netherlands, (2017).
2. Diploma *Consulente Ambientale* obtained by Eureka Formazione, Policoro, Italy, (2017).
3. Diploma *Consulente Energetico* obtained by Eureka Formazione, Policoro, Italy, (2017).
4. Specialization in: *Corso di Formazione Docenti Formatori e Responsabili Progetti Formativi* obtained by Eureka Formazione, Policoro, Italy, (2017).
5. Specialization in: *Safety Manager* obtained by Eureka Formazione, Policoro, Italy, (2017).
6. Specialisation in: *Campi Elettromagnetici, Valutazione del Rischio e Protezione*, University of Naples "Federico II", Physics Department, Naples, (2016).
7. Diploma A.N.F.O.S. *Sicurezza nei cantieri edili*, Nocera, Italy, validity: 2016-2021, (2016).
8. Specialization courses in Physics and Management within the *Progetto di Formazione Specialistica: Una Nuova Frontiera per la Ricerca: Gli Osservatori Sottomarini*, Catania, INFN-LNS, Italy, (2015).
9. Diploma *Operatore su Personal Computer* obtained by C.P.F. school, Solofra, Italy, (1996).

Current affiliations:

1. Affiliated to the Mathematics Department, University of Pisa, Pisa, Italy.
2. Affiliated to the Physics Division of the School of Science and Technology, University of Camerino, Camerino, Italy.
3. Affiliated to the Physics Department, Al-Farabi Kazakh National University, Almaty, Kazakhstan.

Past affiliations:

1. Affiliated to INFN (National Institute for Nuclear Physics), section of Frascati, Italy.
2. Affiliation to INFN (National Institute for Nuclear Physics), section of Naples, Italy.
3. Affiliation to the Department of Physics, University of Naples "Federico II", Naples, Italy.
4. Affiliation to INAF (national Institute for Astrophysics), section of Naples, Italy.
5. Affiliation to the Department of Mathematics and Applied Mathematics, University of Cape Town, Cape Town, South Africa.
6. Affiliation to the Institute for Nuclear Science (ICN), Universidad Nacional Autónoma de México, (UNAM), Mexico City, Mexico.
7. Affiliation to the Department of Physics, University of Rome "La Sapienza", Rome, Italy.

Current memberships:

1. Member of SIMCA, *Italian Society of Celestial Mechanics*.

Past memberships:

1. Member of SIF, *Italian Society of Physics*.

RESEARCH ACTIVITIES

Summary of publications:

1. Total number of works: > **110**
2. Total articles with peer review process: $\sim$ **90**
3. Total single authored: 4
4. Total chapters of books: 6
5. Total published books: 1
6. Total expected books: 3
7. Total proceedings with peer review process: 9
8. Total number of citations: $\sim$ **2200**
9. h-factor: **27**

data got from: <https://inspirehep.net>

Last update: *April 2022*

Published Books:

1. Co-Author of the book: “Introduzione ai Metodi matematici delle Scienze Fisiche”, in collaboration with prof. Stefano Mancini, McGraw-Hill, Milan, ISBN: 9788838654947, January 2022.

Incoming Books:

1. Co-Author of the book: “A primer of General Relativity and Cosmology” in collaboration with prof. Peter K. S. Dunsby, World Scientific, Singapore, first version Expected by the end of 2022.
2. Co-Author of the book: “Gamma-ray Bursts: origin and applications to cosmology” in collaboration with Dr. Marco Muccino, Lambert, first version Expected by the end of 2022.
3. Co-Author of the book: “Cosmography and cosmology” in collaboration with Dr. Francesco Pace, World Scientific, first version Expected by the end of 2023.

List of scientific interests:

In particular, he is greatly interested in the following topics:

- Cosmology:

Dark energy: unified models, thermodynamic models, effective field models.

Dark matter physics: accretion disks, mass constituents, structure formation.

Extended and modified theories of gravity in homogeneous and inhomogeneous universes.

- Cosmography:

Effective model-independent reconstructions of dark fluids.

Null diagnostics, Monte Carlo analysis and machine learning techniques.

Cosmographic thermodynamics and the interplay with effective field cosmology.

- Quantum information:

Quantum gravity and quantum cosmology in information theory.

Relativistic quantum information theory.

Entanglement from geometric particle production in various theories of gravity.

- Field theories:

Neutrino oscillation in strong gravitational fields.

Effective fields in inflationary phase and quantum vacuum energy.

Quantum Chromodynamics and baryogenesis.

- Thermodynamics:

Thermodynamic aspects of present and early time cosmology.

Black hole physics and thermodynamics, gravitational collapse and repulsive effects.

Thermodynamic lengths, Geometrothermodynamics and Legendre invariance.

- General relativity and theoretical astrophysics:

Local and cosmological tests of general relativity.

Exact solutions and absolute calculus in general relativity.

Relativistic astrophysics: Gamma Ray Bursts, Magnetars, Quasars, etc.

Scientific activity and developments:

Below, the principal goals of the Orlando Luongo scientific career are listed into four main highlights.

- Context: **Cosmology and Cosmography.** Title: *Model independent cosmological reconstructions to discriminate dark energy and dark matter models*

He proposed how to handle modern cosmography reducing systematics and enabling the universe kinematics to be predictive. He proposed the use of Padé and Chebyshev polynomials in two distinct seminal papers (Gruber, Luongo, PRD, 89, 103506, (2014) and Capozziello, D'Agostino, Luongo, MNRAS, 476, 3924, (2018)). He introduced a new treatment of cosmic analysis, named the Eis method, capable of removing systematics (Aviles, Klapp, Luongo, PDU, 17, 25, (2017)). He showed the use of cosmography may also reveal the correct gravitational theory and well adapts to understanding whether and how the universe expansion history is effectively modified due to possible extended theories of gravity. Recent applications to thermodynamics and field theories have been carried out (see, e.g. Capozziello, D'Agostino, Luongo, ArXiv[astro-ph]:2202.03300 and Capozziello, D'Agostino, Giambò, Luongo, PRD, 99, 023532, (2019)).

- Context: **Information theory.** Title: *Entanglement in relativistic frameworks*

He proposed a new paradigm of quantum cosmology in which the cosmological constant is reproduced as a byproduct of entangled states and statistically correlated minisuperspaces (Capozziello, Luongo, Entropy, 13, 2, 528, (2011) and Capozziello, Luongo, Mancini, PLA, 377, 1061, (2013)). To show that, he considered two quantum epochs corresponding to two correlated eras and he computed the density matrix with the assumption that an entangled final state leads to a non-vanishing Von Neumann entropy. Its magnitude could be interpreted, in view of recent observations, as the cosmological constant, healing *de facto* the coincidence problem between matter and vacuum energy. Moreover, he proposed how to get a geometric contribution to matter creation. He investigated how this fact can modify the net entanglement measures (Belfiglio, Luongo, Mancini, PRD 104, 043523, (2021) and ArXiv[gr-qc]:2201.12299).

- Context: **Field theories.** Title: *Vacuum energy cancellation mechanism*

He proposed that, during early-time transition, dark matter's field cancels out quantum field fluctuations of vacuum energy (Luongo, Muccino, PRD, 98, 103520, (2018)). This mechanism leads to an alternative to the standard cosmological model presuming that matter, i.e. baryons and cold dark matter, exhibits a non-vanishing pressure mimicking the cosmological constant effects. The mechanism of cancellation provides a negative and constant pressure whose magnitude is determined by baryons only at late times. To frame this process out, he presumed a scalar field Lagrangian introducing a Lagrange multiplier as constraint and a symmetry breaking effective potential. The corresponding cosmological scenario is equivalent to unified dark fluid (Dunsby, Luongo, Reverberi, PRD, 94, 083525, (2016)) with vanishing speed of sound. He thus predicted possible dark matter candidates whose masses span in the range 0.5 – 1.7 TeV and he interpreted them in terms of geometric quasi-particles (Luongo, Marcantognini, Muccino, ArXiv[hep-th]:2112.05730).

- Context: **Thermodynamics.** Title: *Geometrothermodynamics and interconnections with black holes and naked singularities*

He formulated dark energy models from Geometrothermodynamics (Bravetti, Luongo, IJGMP, 11, 08, 1450071, (2014)). He also proposed to connect thermodynamic lengths among them in order to unify different thermodynamic descriptions (Cafaro, Luongo, Mancini, Quevedo, Physica A, 590, 126740, (2022)). Concerning black hole and naked singularity thermodynamics, he investigated how to handle repulsive gravity effects in several scenarios near compact objects by using an invariant method to characterize regions of repulsive gravity, associated to black holes and naked singularities. His method is new and is based on the behavior of the curvature tensor eigenvalues, and leads to an invariant definition of a *repulsion radius* (Luongo, Quevedo, PRD, 90, 084032, (2014)).

Referee for:

1. Reports on Progress in Physics.
2. Physics Letters B.
3. Physics Letters A.
4. Classical and Quantum Gravity.
5. General Relativity and Gravitation.
6. Physics of the Dark Universe.
7. The European Physical Journal C.
8. The European Physical Journal Plus.
9. Scientific Reports.
10. International Journal of Modern Physics D.
11. International Journal of Modern Physics A.
12. Modern Physics Letter A.
13. Physica Scripta.
14. International Journal of Geometric Methods in Modern Physics.
15. Astrophysics and Space Sciences.
16. Advances in Space Research
17. Computer Physics Communications.
18. Universe.
19. Entropy.
20. Galaxy.
21. Symmetry.
22. Chaos, Solitons & Fractals.
23. Optik.
24. Mathematical and Computational Applications.

Editorial activities:

- Editor for the journal *International Journal of Geometrical Methods in Modern Physics*, World Scientific,
website: www.worldscientific.com/worldscinet/ijgmmp
- Editor for the journal *Galaxies*, MDPI,
website: www.mdpi.com/journal/galaxies/editors
- Managing Editor for Publishing House: "*Licosia Edizioni*", section "Eleatiche", Rome, Italy,
website: www.licosia.com/?page_id=17783

**Invited special issues
guest editor:**

1. Lead Guest Editor for the special issue: *Beyond the Standard Cosmological Model in the Multi-messenger Era* on Symmetry, MDPI, website: www.mdpi.com/journal/symmetry/special_issues/Beyond_Standard_Cosmological_Model_Multi-messenger_Era, (2020).
2. Lead Guest Editor for the special issue: *Theories of Gravity: Alternatives to the Cosmological and Particle Standard Models* on Universe, MDPI, website: www.mdpi.com/journal/universe/special_issues/gravity_theories, (2020).
3. Lead Guest Editor for the special issue: *Dark Cosmology: Shedding Light on Our Current Universe* on Galaxy, MDPI, website: www.mdpi.com/journal/galaxies/special_issues/DarkCosmology, (2021).
4. Guest Editor for the special issue: *New Solutions of Einstein Equations in Spherical Symmetry* on Symmetry, MDPI, website: www.mdpi.com/journal/symmetry/special_issues/Einstein_Equations_Spherical_Symmetry, (2021).

**Research periods in
foreign institutions:**

1. December 2009 - January 2010, visiting PhD student at the University of Canterbury, Christchurch, New Zealand
2. February 2010 - August 2010, visiting PhD student at the University of Cote Azur, Nice, France.
3. January 2011 - April 2011, ICN, visiting PhD student, University of Mexico (UNAM), Mexico City, Mexico.
4. July 2012 - December 2012, Research Associate at ICN, University of Mexico (UNAM), Mexico City, Mexico.
5. July 2015 – December 2015, Postdoctoral fellowship at the Department of Mathematics, University of Cape Town, South Africa.
6. December 2018, Visiting Researcher, at the Physics Department, Nazarbayev University, Astana, Kazakhstan.
7. June 2022 (expected), Visiting Researcher, at the Physics Department, Al-Farabi University, Almaty, Kazakhstan.

**Research stages in
National institutions:**

1. September 2010, visiting PhD student at the Physics Department of the Ferrara University, Ferrara, Italy.

**Responsibilities in
laboratory:**

1. Product Assurance manager for the Laser Relativity Satellite (Lares) 2 Satellite on the first flight of Vega-C for the measurement of the Lense–Thirring effect in the Solar System.
2. Optical analyst for microreflectors for the missions LaRRI (Laser RetroReflector for InSight) and LaRA (Laser RetroReflector Array), landed on Mars on 2018 and 2020, respectively.
3. Data acquisition and optical tests in laboratory on new generation space-qualified retroreflectors.

Research responsibilities:

1. Lead researcher of theoretical gravitational physics at the SCF-Laboratory, INFN, concerning numerical predictions on PPN parameters and orbits. Collaboration with NASA, USA, concerning gravitational physics for Lunar missions.
2. Lead researcher of theoretical gravitational physics for the SCF-Laboratory on developing technical specifications for advanced design/construction of new clean rooms devoted to tests and manufacturing over reflectors and space instruments.
3. Lead researcher at the SCF-Laboratory, INFN, for numerical tests of optical data through highly-performing specialized software, e.g. Planetary Ephemeris Program (PEP) and Code V.
4. Theorist, product assurance manager and quality assurance manager for Moon-LIGHT and Lares2 experiments at SCF-Laboratory, INFN.
5. Theorist for scientific activities at INFN concerning new generation of microreflectors for the mission CSG-FM3-4 (COsmo-SkyMed Second Generation - Flight Model 3 and 4), Ministero della Difesa and Italian Space Agency (ASI).
6. Leading expert of gravitational physics and relativistic effects at the University of Pisa, Department of Mathematics, for the Bepi Colombo mission: theoretical computation and use of specialized software, Orbit14.
7. Leading expert of gravitational physics and relativistic effects at the University of Pisa, Department of Mathematics, for the Juno mission, ASI-NASA.
8. Leading research associate to the Al-Farabi Kazakh National University, Almaty, Kazakhstan.
9. Research associate as Foreign Adjunct Professor at the Institute of Fundamental and Applied Research, National Research University "TIIAME", Tashkent, Uzbekistan.

Research grants:

1. 2020-2022, Chief research associate for grant IRN: AP08052311, "Astrophysical implications of white dwarf stars", Al-Farabi National University of Almaty, Kazakhstan.
2. 2018-2020, Chief research associate for grant IRN: BR05236494, "Fundamental and applied studies in related fields of physics of terrestrial, near-Earth and atmospheric processes and their practical application", Al-Farabi National University of Almaty, Kazakhstan.

TEACHING ACTIVITIES

Teaching experience:

Teaching basic and advanced courses represents a relevant part of the Orlando Luongo activities. He enjoys interacting with students at all levels. He also experiments different ways of monitoring students progress, interacting with them in small groups and laboratories. Students are continually assessed via a series of problem solving and multiple choice problem sheets on specific topics. He regularly uses computer algebra systems, and numerical simulations in classroom demos to give different perspectives on physical problems, providing a much needed link to situations of importance in everyday life. His teaching experiences are listed below.

List of teaching experiences:

At the University of Camerino, Camerino, Italy:

1. Adjunct Assistant Professor (professore a contratto) for the course “Quantum Field Theory”, 6 CFU, at the University of Camerino, Master’s Degree in Physics, Camerino, Italy, from 2017 to date.
2. Adjunct Assistant Professor (professore a contratto) for the course “Cosmology”, 6 CFU, at the University of Camerino, Master’s Degree in Physics, Camerino, Italy, from 2019 to date.
3. Adjunct Assistant Professor (professore a contratto) for the course “Theoretical Physics”, 6 CFU, at the University of Camerino, Master’s Degree in Physics, Camerino, Italy, from 2021 to date.
4. Teaching experience for the course “Metodi Matematici per la Fisica” (Mathematical Methods for Physics) at the University of Camerino, Camerino, Italy, 2017, for a total of 25 hours, in collaboration with Prof. Stefano Mancini.
5. Teaching experience for the course “Metodi Matematici per la Fisica” (Mathematical Methods for Physics) at the University of Camerino, Camerino, Italy, 2018, for a total of 25 hours, in collaboration with Prof. Stefano Mancini.

At the University of Naples "Federico II", Naples, Italy:

1. Teaching experience for the course “Metodi Matematici per la Fisica” (Mathematical Methods for Physics) at the University of Naples “Federico II”, Naples, Italy, 2016, for a total of 20 hours, in collaboration with Prof. Fedele Lizzi.
2. Teaching experience for the course “Fisica Generale” (General Physics) at the University of Naples “Federico II”, Naples, Italy, 2016, for a total of 20 hours, in collaboration with Prof. Salvatore Capozziello.
3. Teaching experience for the course “Cosmologia” (Cosmology) at the University of Naples “Federico II”, Naples, Italy, 2016, for a total of 10 hours, in collaboration with Prof. Salvatore Capozziello.
4. Co-Teaching experience for the PhD course “Constraining Cosmologies using CosmoMC and CAMB” at the University of Naples “Federico II”, Naples, Italy, 2016, for a total of 9 hours, in collaboration with Dr. Jason Dossett.
5. Teaching support for the course “Astroparticle Physics” at the University of Naples “Federico II”, Naples, Italy, 2014, for a total of 8 hours, in collaboration with Prof. Giancarlo Barbarino.

At the University of Sannio, Benevento, Italy:

1. Adjunct Assistant professor with Co.Co.Co. for the course “Fisica” (Physics) at the University of Benevento, Unisannio, Italy, for the bachelors in Civil Engineering (Ingegneria Civile) and Energetic Engineering (Ingegneria Energetica), 1 year during 2016/2017, for a total of 40 hours.
2. Adjunct Assistant professor with Co.Co.Co. for the course “Fisica Generale” (General Physics) at the University of Benevento, Unisannio, Italy, for the bachelors in Computer Engineering (Ingegneria Informatica) and T.L.C. Engineering (Ingegneria Elettronica per l’Automazione e le Telecomunicazioni), 1 year during 2016/2017, for a total of 40 hours.
3. Adjunct Assistant professor with Co.Co.Co. for the course “Matematica 1” (Calculus) at the University of Benevento, Unisannio, Italy, for the bachelor in Energetic Engineering (Ingegneria Energetica), 1 year during 2016/2017, for a total of 40 hours.
4. Adjunct Assistant professor with Co.Co.Co. for the course “Fisica” (Physics) at the University of Benevento, Unisannio, Italy, for the bachelors in Civil Engineering (Ingegneria Civile) and Energetic Engineering (Ingegneria Energetica), 1 year during 2015/2016, for a total of 30 hours.
5. Adjunct Assistant professor with Co.Co.Co. for the course “Fisica Generale” (General Physics) at the University of Benevento, Unisannio, Italy, for the bachelors in Computer Engineering (Ingegneria Informatica) and T.L.C. Engineering (Ingegneria Elettronica per l’Automazione e le Telecomunicazioni), 1 year during 2015/2016, for a total of 60 hours.

At the University of Rome "La Sapienza", Rome, Italy:

1. Teaching support for the course “Theoretical physics” at the University of Rome “La Sapienza”, Rome, Italy, 2009-2010, for a total of 6 hours, (ITALY).

**Supervisor for
undergraduate
students:**

1. 9 master students,
2. 7 bachelor students.

**List of master students
and theses:**

1. Supervisor of the master's thesis with (expected) title: *Unifying inflation and dark energy with multifield cosmology*, University of Camerino, 2022/2023, (Italy), Student: Tommaso Mengoni, expected by April 2023.
2. Supervisor of the master's thesis with (expected) title: *Solving the cosmological constant problem through matter with pressure*, University of Camerino, 2022/2023, (Italy), Student: Youri Carloni, expected by April 2023.
3. Supervisor of the master's thesis with (expected) title: *Unified dark energy - dark matter models*, University of Cape Town, 2022/2023, (South Africa), Student: Vineshree Pillay, expected by the end of 2022.
4. Supervisor of the master's thesis with (expected) title: *Model independent reconstruction of cosmological accelerated-decelerated phase*, University of Naples "Federico II", 2022/2023, (Italy), Student: Anna Chiara Alfano, expected by the end of 2022.
5. Supervisor of the master's thesis with (expected) title: *Fractal universe*, University of Camerino, 2022/2023, (Italy), Student: Randolfo Frattesi, expected by the end of 2022.
6. Supervisor of the master's thesis *Unifying baryogenesis with dark matter production*, School of Higher Studies "Carlo Urbani", University of Camerino, 2020/2021, (Italy), Student: Nicola Marcantognini, Final vote: 100/100.
7. Supervisor of master's thesis with title: *Information entropy and particle production from non-perfectly moving mirrors*, University of Camerino, 2020/2021, (Italy), Student: Alessio Lapponi, Final vote: 110/110 cum laude.
8. Supervisor of master's thesis with title: *Entanglement in model independent cosmological scenario with torsion*, University of Camerino, 2020/2021, (Italy), Student: Alessio Belfiglio, Final vote: 110/110 cum laude.
9. Supervisor of the master's thesis with title: *Il problema cosmografico con differenti definizioni di distanza*; University of Naples, "Federico II", 2014/2015, (Italy), Student: Ilenia De Rubertis, Final vote: 108/110.

List of bachelor students and theses:

1. Supervisor of bachelor's thesis with title: *Buchi neri e informazione*, University of Camerino, 2021/2022, (Italy), Student: Paolo Pierosara, expected by June 2022.
2. Supervisor of bachelor's thesis with title: *I wormholes: dalla relatività generale all'entanglement quantistico*, University of Camerino, 2017/2018, (Italy), Student: Alessia Cardinali, Final vote: 110/110 cum laude.
3. Supervisor of bachelor's thesis with title: *Il modello cosmologico standard*, University of Camerino, 2017/2018, (Italy), Student: Daniele Sonaglioni, Final vote: 110/110 cum laude.
4. Supervisor of bachelor's thesis with title: *Gruppi quantistici e computazione quantistica*, University of Camerino, 2017/2018, (Italy), Student: Alessio Lapponi, Final vote: 110/110 cum laude.
5. Supervisor of bachelor's thesis with title: *Cosmologia e informazione quantistica*, University of Naples, "Federico II", 2016/2017, (Italy), Student: Luca Donofrio, Final vote: 110/110 cum laude.
6. Supervisor of bachelor's thesis with title: *L'approccio standard alla quantizzazione della gravità e la funzione d'onda dell'universo*, University of Naples, "Federico II", 2015/2016, (Italy), Student: Oriana D'Angola, Final vote: 105/110.
7. Supervisor of bachelor's thesis with title *La metrica di Kerr per momenti angolari supercritici*; University of Rome "La Sapienza", 2010/2011, (Italy), Student: Gabriele Nunzio Tornetta, Final vote: 110/110 cum laude.

Tutor for graduate students:

1. 3 Postdoctoral students,
2. 5 PhD students.

Postdoctoral students:

1. Co-Tutor for the Post-Doc fellowship of Dr. Rocco D'Agostino at the SSM and University of Naples "Federico II", Naples, Italy, period: 2021-2024.
2. Co-Tutor for the Post-Doc fellowship of Dr. Rocco D'Agostino at the University of Naples "Federico II", Naples, Italy, period: 2019/2020.
3. Co-Tutor for the Post Doc fellowship of Dr. Marco Muccino at the National Institute for Nuclear Physics, INFN, Frascati, Italy, period: 2017/2018.

PhD students:

1. Co-Supervisor for the PhD student Mr. Alessio Lapponi at the SSM and University of Naples "Federico II", Naples, Italy, period: 2021-2025.
2. Co-Supervisor for the PhD student Mr. Alessio Belfiglio at the University of Camerino, Camerino, Italy, period: 2021-2024.
3. Co-Supervisor for the PhD student Mr. Yaroslav Sidorov at the Al-Farabi Kazakh National University, Kazakhstan, period: 2020-2023.
4. Co-Supervisor for the PhD student Mr. Ergali Kurmanov at the Al-Farabi Kazakh National University, Kazakhstan, period: 2020-2022. Final evaluation June 2022.
5. Co-Supervisor for the PhD student Mr. Talgar Konysbayev at the Al-Farabi Kazakh National University, Kazakhstan, period: 2019-2022. Final evaluation on December 2022.

OUTREACH AND UNIVERSITY ORIENTATION

1. Scientific disseminator for *Percorsi culturali di eccellenza: Sapere Aude* with the talk *Il bosone di Higgs - The Higgs boson* at the High-School "Leonardo Da Vinci", Salerno, Italy, (2013).
2. Scientific disseminator for high school students at the SCF_Lab, INFN, Frascati, Italy, (2018).
3. Internal research activity speaker for bachelor students at the University of Camerino, physics division, Camerino, Italy, since 2017 to date.
4. Research speaker at "I primi trent'anni della Fisica a Camerino", University of Camerino, Camerino, Italy, (2017).
5. Tutor for the stage of students *Porte aperte in un'amicizia Estate 2020*, during the period from July 8th to August 7th 2020 and Speaker on theoretical physics and cosmology at the *Open Day*, University of Camerino, physics division, Camerino, Italy, (2020)
6. Scientific disseminator for "Viaggi della conoscenza" with the following talks: "Dal Big Bang all'Energia oscura", "Le particelle elementari, il bosone di Higgs e la nuova fisica delle particelle" and "Buchi neri ed effetti quantistici" for the University of Camerino, physics division, Camerino, Italy, since 2021 to date.

International Collaborations:

1. 2009 - now, Collaboration with Prof. Hernando Quevedo, UNAM University, Mexico.
2. 2009 - 2012, Collaboration with Prof. Patrick Roy Kerr, Canterbury University, New Zealand.
3. 2010 - now, Collaboration with Dr. Alessandro Bravetti, Instituto de Investigaciones en Matematicas Aplicadas y en Sistemas, Mexico, Mexico.
4. 2010 - now, Collaboration with Dr. Alejandro Aviles, Consejo Nacional de Ciencia y Tecnologia, Mexico.
5. 2013 - now, Collaboration with Prof. Bharat Ratra, Kansas University, USA.
6. 2014 - 2018, Collaboration with Prof. Jaime Klapp, IPN Institute, Mexico.
7. 2014 - 2018, Collaboration with Prof. Norman Cruz, Universidad de Santiago de Chile, Chile.
8. 2014 - now, Collaboration with Prof. Emmanuel N. Saridakis, National Observatory of Athens, Greece.
9. 2015 - now, Collaboration with Prof. Predrag Jovanovic, Astronomical Observatory, Volgina, Belgrade, Serbia.
10. 2015 - now, Collaboration with Prof. Vesna Borka Jovanovic, Vinca Institute of Nuclear Sciences, Belgrade, Serbia.
11. 2015 - now, Collaboration with Prof. Dusko Borka, Vinca Institute of Nuclear Sciences, Belgrade, Serbia.
12. 2015 - 2016, Collaboration with Dr. Alvaro de la Cruz, University of Cape Town, South Africa.
13. 2015 - now, Collaboration with Prof. Peter Dunsby, University of Cape Town, South Africa.
14. 2018 - now, Collaboration with Prof. Daniele Malafarina, Nazarbayev University, Kazakhstan.
15. 2018 - now, Collaboration with Prof. Kuantay Boshkayev, Al-Farabi Kazakh National University, Kazakhstan.
16. 2018 - 2019, Collaboration with Dr. Konstantinos F. Dialektopoulos, Aristotle University of Thessaloniki, Greece.
17. 2019 - now, Collaboration with Dr. Carlo Cafaro, SUNY Polytechnic Institute, USA.
18. 2019 - now, Collaboration with Prof. Hachemi B. Benaoum, University of Sharjah, United Arab Emirates.
19. 2020 - now, Collaboration with Prof. Michael R. R. Good, Nazarbayev University, Kazakhstan.
20. 2021 - now, Collaboration with Prof. Valerio Faraoni, Bishop University, Canada.
21. 2021 - now, Collaboration with Prof. Eoin Ó Colgain, Sogang University, Korea.
22. 2022, Collaboration with Seyed Ali Hosseini Mansooria, Shahrood University of Technology, Iran.
23. 2022, Collaboration with Morteza Rafiee, Shahrood University of Technology, Iran.

National Collaborations:

1. 2008 - now, Collaboration with Prof. Salvatore Capozziello, University of Naples, Naples, Italy.
2. 2009 - 2014, Collaboration with Prof. Gerardo Cristofano, Physics Department, University of Naples, Naples, Italy.
3. 2009 - 2013, Collaboration with Dr. Andrea Geralico, International Center for Relativistic Astrophysics, Pescara, Italy.
4. 2013 - 2015, Collaboration with Prof. Giancarlo Barbarino, Physics Department, University of Naples, Naples, Italy.
5. 2013 - now, Collaboration with Prof. Stefano Mancini, School of Science and Technology, University of Camerino, Camerino, Italy.
6. 2016 - now, Collaboration with Prof. Fedele Lizzi, Physics Department, University of Napoli, Napoli, Italy.
7. 2016 - now, Collaboration with Prof. Patrizia Vitale, Physics Department, University of Napoli, Napoli, Italy.
8. 2016 - now, Collaboration with Dr. Raffaele Marotta, Physics Department, University of Napoli, Napoli, Italy.
9. 2017 - 2020, Collaboration with Dr. Simone Dell'Agnello, INFN, Frascati, Italy.
10. 2017 - now, Collaboration with Dr. Stefano Morisi, Physics Department, University of Napoli, Napoli, Italy.
11. 2017 - now, Collaboration with Dr. Giovanni Ottavio Delle Monache, INFN, Frascati, Italy.
12. 2017 - now, Collaboration with Dr. Marco Muccino, INFN, Frascati, Italy.
13. 2017 - now, Collaboration with Dr. Rocco D'Agostino, SSM, Naples, Italy.
14. 2018 - 2020, Collaboration with Dr. Stefano Bellucci, INFN, Frascati, Italy.
15. 2018 - now, Collaboration with Mrs. Maria Tantalò, University of Rome Tor Vergata, Italy.
16. 2018 - now, Collaboration with Dr. Danilo Babusci, INFN, Frascati, Italy.
17. 2018 - now, Collaboration with Dr. Antonio Capolupo, Physics Department, University of Salerno, Salerno, Italy.
18. 2018 - now, Collaboration with Dr. Francesco Pace, University of Turin, Turin, Italy.
19. 2018 - now, Collaboration with Prof. Roberto Giambò, School of Science and Technology, University of Camerino, Camerino, Italy.
20. 2018 - now, Collaboration with Dr. Lorenzo Amati, INAF, Bologna, Italy.
21. 2020 - now, Collaboration with Prof. Giacomo Tommei, University of Pisa, Pisa, Italy.
22. 2021 - now, Collaboration with Mr. Alessio Lapponi, SSM, Naples, Italy.
23. 2021 - now, Collaboration with Mr. Alessio Belfiglio, University of Camerino, Camerino, Italy.

**Chairman of
conferences/Invited
talks:**

1. Chairman for the sixteenth Marcel Grossmann Meeting - MG16, University of Rome "La Sapienza", July 5-10, 2021, Rome, Italy, website: www.icra.it/mg/mg16/par_sessions_chairs_details.htm
2. Chairman for the fifteenth Marcel Grossmann Meeting - MG15, University of Rome "La Sapienza", July 1-7, 2018, Rome, Italy, website: www.icra.it/mg/mg15/par_sessions_chairs_details.htm
3. Invited talk at the *sixteenth Marcel Grossmann Meeting - MG16*, University of Rome "La Sapienza", 2021, Rome, Italy.
4. Invited talk at the *fifteenth Marcel Grossmann Meeting - MG15*, University of Rome "La Sapienza", 2021, Rome, Italy.
5. Invited talk at Spontaneous Workshop XIII, *Hot topics in Modern Cosmology*, 5-11 May 2019 — IESC, Cargèse, France, website: www.cpt.univ-mrs.fr/cosmo/SW_2019/SW13.html
6. Invited talk at the Astronomical Observatory of Capodimonte, 12 June 2019, Naples, Italy (participation declined).
7. Invited talk at the Astronomical Observatory of Monte Porzio Catone, 2018, Monte Porzio (RM), Italy (participation declined).
8. Invited talk at the Physics Department of Nazarbayev University, Astana, Kazakhstan, December 1-8, 2018, Astana, Kazakhstan, title: *Accelerating the universe with matter with pressure*
9. Invited talk at the University of Camerino, "I primi trent'anni della Fisica a Camerino", Camerino, 28-29 September, 2017, Italy.

**Organizer of
conferences:**

1. Organizer of "Monthly Seminars of General Relativity and Gravitation" at the Institute of Nuclear Science, 2012, Mexico City, Mexico.
2. Organizer of the parallel section AT7 for the Conference *Fifteenth Marcel Grossmann Meeting - MG15*, University of Rome "La Sapienza", 2018, Rome, Italy.
3. Organizer of the seminar "Astrophysical consequences of white dwarf stars" by Prof. Kuantay Koshkayev, at the University of Camerino, School of Science and Technology, 2019, Camerino, Italy.
4. Organizer of the parallel section AT4 for the Conference *Sixteenth Marcel Grossmann Meeting - MG16*, University of Rome "La Sapienza", 2021, Rome, Italy.
5. Organizer of the seminar "Black holes mimickers" by Prof. Daniele Malafarina, at the University of Camerino, School of Science and Technology, 2021, Camerino, Italy.
6. Organizer of the seminar "Black holes and wormholes: possible time machines?" by Prof. Salvatore Capozziello, at the University of Camerino, School of Science and Technology, 2022, Camerino, Italy.

Schools:

1. Scuola Nazionale di Astrofisica, *Oggetti compatti e pulsar - Scienza con ALMA*, maggio 20-26, (2007), Maracalagonis (CA), Italy.
2. SIGRAV School (INFN cosmological school): *Coarsed grained cosmology*, held at the Institute of Theoretical Physics Galileo Galilei, January 26-29, (2009), Firenze, Italy.
3. Majorana lectures, February 9-13, (2015), Naples, Italy.
4. Majorana lectures, March 14-16, (2016), Naples, Italy.
5. International School on *Space Optics*, October 2-6, (2017), ESA-ESTEC, The Netherlands.

Attended conferences:

1. 6th Italian-Sino Workshop, Relativistic Astrophysics, June 29 - July 1, Pescara, 2009, Italy.
2. 2nd Italian-Pakistani Workshop, Relativistic Astrophysics, July 8 - 10, Pescara, 2009, Italy.
3. 5th Australasian Conference - Christchurch Meeting December 16-18, 2009, Christchurch, New Zealand.
4. Conference Cosmology on the beach, Puerto Vallarta, January 10-14, 2011, Mexico.
5. 12th Italian-Korean Symposium, July 4-8, 2011, Pescara, Italy.
6. The 13th Marcel Grossmann Meeting, Stockholm University, July 1 - 7, Stockholm, 2012, Sweden.
7. Conference *Current Problems in Theoretical Physics*, March 18 - 21, Lloyd's Baia Hotel, Vietri sul Mare, 2015, Italy.
8. Conference *Current Problems in Theoretical Physics*, March 18 - 23, Lloyd's Baia Hotel, Vietri sul Mare, 2016, Italy.

Attended conferences with talks:

1. The 12th Marcel Grossmann Meeting, in Paris, France, hosted jointly by ICRANet, UNESCO and ICTP, July 13th-18th, (2010), Paris, France.
2. Fourteenth Marcel Grossmann Meeting - MG14, University of Rome "La Sapienza", July 12-18, (2015), Rome, Italy.
3. The South African Gravity Society Meeting, 2015, Port Elizabeth, 6031, Rhodes University, 31/08/2015-02/09/2015, South Africa.
4. Conference *Lunar Science for Landed Missions Workshop*, January 10-12, NASA Ames Campus, (2018), Mountain View, USA.
5. Conference *Fifteenth Marcel Grossmann Meeting - MG15*, University of Rome "La Sapienza", July 1-7, (2018), Rome, Italy.
6. Conference *Sixteenth Marcel Grossmann Meeting - MG16*, University of Rome "La Sapienza", July 5-10, (2021), Rome, Italy.
7. Conference *13th Italian Quantum Information Science Conferences*, University of Naples "Federico II", October 10-15, (2021), Naples, Italy.

References:

1. Prof. Stefano Mancini, Full Professor, University of Camerino, Camerino, Italy. Email: stefano.mancini@unicam.it
2. Prof. Roberto Giambò, Full Professor, University of Camerino, Camerino, Italy. Email: roberto.giambo@unicam.it
3. Prof. Hernando Quevedo, Full Professor, UNAM University, Mexico City, Mexico. Email: quevedo@nucleares.unam.mx
4. Prof. Peter K. S. Dunsby, Full Professor, Cape Town University, Cape Town, South Africa. Email: peter.dunsby@uct.ac.za
5. Prof. Salvatore Capozziello, Full Professor, University of Naples, Naples, Italy. Email: capozzie@na.infn.it
6. Prof. Kuantay Boshkayev, Full Professor, Al-Farabi Kazakh National University, Almaty, Kazakhstan. Email: kuantay@mail.ru
7. Prof. Giacomo Tommei, Associate Professor, University of Pisa, Department of Mathematics, Pisa, Italy. Email: giacomo.tommei@dm.unipi.it
8. Prof. Daniele Malafarina, Associate Professor, Nazarbayev University, Nur-Sultan, Kazakhstan. Email: danielle.malafarina@nu.edu.kz
9. Dr. Lorenzo Amati, Executive Researcher, National Institute for Astrophysics, Bologna, Italy. Email: lorenzo.amati@inaf.it
10. Dr. Giovanni Ottavio Delle Monache, Senior researcher, National Institute for Nuclear Physics, Frascati, Italy. Email: dellemonache@lnf.infn.it

Additional information

1. (2007) student representative at the Physics Department of the Salerno University.
2. Driving licence: Patente B.

Personal interests

Play violin and piano. Movie maker. Bike riding. Poetry. Novel writer. Cooking.

List of all publications by Orlando Luongo

Published peer-reviewed articles

1. Donato Bini, Andrea Geralico, **Orlando Luongo**, Hernando Quevedo,
Generalized Kerr spacetime with an arbitrary mass quadrupole moment: geometric properties versus particle motion,
ArXiv[gr-qc]:0909.4150
DOI: 10.1088/0264 – 9381/26/22/225006
Classical and Quantum Gravity, **26**, 225006, 23 pages, (2009).
2. **Orlando Luongo**, Gerardo Iannone, Carmine Autieri,
Scale-free model for governing the universe dynamics,
ArXiv[gr-qc]:0902.3746
DOI: 10.1209/0295 – 5075/90/39001
Europhysics Letters, **90**, 39001, 6 pages, (2010).
3. Alejandro Aviles, Luca Bonanno, **Orlando Luongo**, Hernando Quevedo,
Holographic dark matter and dark energy with second order invariants,
ArXiv[gr-qc]:1109.3177
DOI: 10.1103/PhysRevD.84.103520
Physical Review D, **84**, 103520, 9 pages, (2011).
4. Gerardo Iannone, **Orlando Luongo**,
A mean field approach for Ising models on scale-free networks,
DOI: 10.1142/S0217984911025857
Modern Physics Letters B, **25**, 07, 453-464, 12 pages, (2011).
5. Salvatore Capozziello, **Orlando Luongo**,
Entangled states in quantum cosmology and the interpretation of Λ ,
ArXiv[gr-qc]:1010.3347
DOI: 10.3390/e13020528
Entropy, **13**, 2, 528-541, 14 pages, (2011).
6. **Orlando Luongo**, Gabriele V. Stagno,
Neutrino oscillation at the Lifshitz point,
DOI: 10.1142/S0217732311035663
Modern Physics Letters A, **26**, 17, 1257-1266, 9 pages, (2011).
7. Gerardo Iannone, **Orlando Luongo**,
Dark energy from a scale-free distribution,
DOI: 10.1209/0295 – 5075/94/49002
Europhysics Letters, **94**, 49002, 6 pages, (2011).
8. Alejandro Aviles, Christine Gruber, **Orlando Luongo**, Hernando Quevedo,
Cosmography and constraints on the equation of state of the Universe in various parametrizations,
ArXiv[astro-ph]:1204.2007
DOI: 10.1103/PhysRevD.86.123516
Physical Review D, **86**, 123516, 23 pages, (2012).
9. Andrea Geralico, **Orlando Luongo**,
Neutrino oscillations in the field of a rotating deformed mass,
ArXiv[gr-qc]:1202.5408
DOI: 10.1016/j.physleta.2012.02.043
Physics Letters A, **376**, 1239-1243, 5 pages, (2012).

10. **Orlando Luongo**, Luca Bonanno, Gerardo Iannone,
Second-order invariants and holography,
 ArXiv[hep-th]:1101.5798
 DOI: 10.1142/S0218271812500915
 International Journal of Modern Physics D, **21**, 12, 1250091, 15 pages, (2012).
11. **Orlando Luongo**, Damiano Tommasini,
Cosmological measurements of Lorentz invariance violation at the Lifshitz point,
 DOI: 10.1142/S0218271812500708
 International Journal of Modern Physics D, **21**, 8, 1250070, 13 pages, (2012).
12. **Orlando Luongo**, Hernando Quevedo,
An expanding Universe with constant pressure and no cosmological constant,
 DOI: 10.1007/s10509-011-0937-x
 Astrophysics and Space Science, **338**, 345-349, 5 pages, (2012).
13. Alejandro Aviles, Alessandro Bravetti, Salvatore Capozziello, **Orlando Luongo**,
Updated constraints on $f(R)$ gravity from cosmography,
 ArXiv[gr-qc]:1210.5149
 DOI: 10.1103/PhysRevD.87.044012
 Physical Review D, **87**, 044012, 11 pages, (2013).
14. Salvatore Capozziello, **Orlando Luongo**, Stefano Mancini,
Cosmological dark energy effects from entanglement,
 ArXiv[gr-qc]:1302.5884
 DOI: 10.1016/j.physleta.2013.02.038
 Physics Letters A, **377**, 14, 1061-1064, 4 pages, (2013).
15. Alejandro Aviles, Alessandro Bravetti, Salvatore Capozziello, **Orlando Luongo**,
Cosmographic reconstruction of $f(T)$ gravity,
 ArXiv[gr-qc]:1302.4871
 DOI: 10.1103/PhysRevD.87.064025
 Physical Review D, **87**, 064025, 10 pages, (2013).
16. Salvatore Capozziello, **Orlando Luongo**,
Dark energy from entanglement entropy,
 ArXiv[gr-qc]:1303.1311
 DOI: 10.1007/s10773-013-1562-y
 International Journal of Theoretical Physics, **52**, 2698-2704, 7 pages, (2013).
17. Gerardo Cristofano, **Orlando Luongo**,
A cosmological scaling relation for describing the late time dynamics,
 DOI:10.1155/2013/536832
 Advances in High Energy Physics, **2013**, 536832, 5, 5 pages, (2013).
18. Salvatore Capozziello, Mariafelicia De Laurentis, **Orlando Luongo**, Alan Cosimo Ruggeri,
Cosmographic Constraints and Cosmic Fluids,
 ArXiv[gr-qc]:1312.1825
 DOI:10.3390/galaxies1030216
 (Invited review) Galaxies, **1**, 3, 216-260, 45 pages, (2013).
19. Christine Gruber, **Orlando Luongo**,
Cosmographic analysis of the equation of state of the universe through Padé approximations,
 ArXiv[gr-qc]:1309.3215
 DOI: 10.1103/PhysRevD.89.103506
 Physical Review D, **89**, 103506, 19 pages, (2014).

20. **Orlando Luongo**, Hernando Quevedo,
Cosmographic study of the universe's specific heat: a landscape for Cosmology?,
 ArXiv[gr-qc]:1211.0626
 DOI: 10.1007/s10714-013-1649-z
 General Relativity and Gravitation, **46**, 1649, 13 pages, (2014).
21. **Orlando Luongo**, Damiano Tommasini,
Modeling dark energy through an Ising fluid with network interactions,
 ArXiv[hep-th]:1304.3829
 DOI: 10.1142/S0218271814500230
 International Journal of Modern Physics D, **23**, 3, 1450023, 22 pages, (2014).
22. **Orlando Luongo**, Hernando Quevedo,
A unified dark energy model from a vanishing speed of sound with emergent cosmological constant,
 DOI: 10.1142/S0218271814500126
 International Journal of Modern Physics D, **23**, 1450012, 15 pages, (2014).
23. Alessandro Bravetti, **Orlando Luongo**,
Dark energy from Geometrothermodynamics,
 ArXiv[gr-qc]:1306.6758
 DOI: 10.1142/S0219887814500716
 International Journal of Geometric Methods in Modern Physics, **11**, 08, 1450071, 13 pages, (2014).
24. Salvatore Capozziello, Omer Farooq, **Orlando Luongo**, Bharat Ratra,
Cosmographic bounds on the cosmological deceleration-acceleration transition redshift in $f(\mathcal{R})$ gravity,
 ArXiv[gr-qc]:1403.1421
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Firma

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Valerio MARRA – Curriculum Vitae

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ORCID: [0000-0002-7773-1579](https://orcid.org/0000-0002-7773-1579)

Astronomical Observatory of Trieste,
National Institute for Astrophysics (INAF)

Citizenship: Italian

Languages: Italian (native), English (fluent), Portuguese (fluent)

Main Areas of Research

Theoretical Cosmology – Dark Energy and Dark Matter – Gravitational Lensing – Large Scale Structure –
Inhomogeneous Cosmological Models – Numerical simulations – Data Analysis – Astrophysics of Galaxies

Education

Department of Physics, University of Padova, Italy.

Ph.D. in Physics, January 2005 – December 2007; graduation: March 14, 2008.

Thesis: *A Back-Reaction Approach to Dark Energy* (128 pages), [arXiv:0803.3152](https://arxiv.org/abs/0803.3152).

Advisors: Prof. Sabino Matarrese, Prof. Antonio Masiero.

Department of Physics, University of Padova, Italy.

Master's degree (Laurea V.O.) in Physics, October 1999 – October 2004; graduation: October 12, 2004.

Thesis: *Fundamental constants and their variation induced by a cosmological scalar* (115 pages, in Italian).

Advisors: Prof. Antonio Masiero, Dr. Francesca Rosati. Final grade: 110/110 magna cum laude.

Present Position

Physics Department, Federal University of Espírito Santo, Brazil.

Assistant Professor (Professor Adjunto), November 10, 2014 – present day.

Astronomical Observatory of Trieste, National Institute for Astrophysics, Italy.

Associated Researcher, September 1, 2020 – present day.

Previous Positions

Astronomical Observatory of Trieste, National Institute for Astrophysics, Italy.

Marie Skłodowska-Curie Fellow, September 1, 2020 – February 28, 2022.

Host: Stefano Borgani.

Physics Institute, Federal University of Rio de Janeiro, Brazil.

“Science without Borders” Fellow, April 1, 2014 – October 31, 2014.

Group leader: Prof. Ioav Waga.

Institute for Theoretical Physics, Heidelberg University, Germany.

Postdoctoral Fellow, October 1, 2011 – March 31, 2014.

Group leader: Prof. Luca Amendola.

Department of Physics, University of Jyväskylä, Finland and

Helsinki Institute of Physics, University of Helsinki, Finland.

Postdoctoral Fellow, October 1, 2008 – September 30, 2011.

Group leader: Prof. Kimmo Kainulainen.

Visiting Positions

Kavli Institute for Cosmological Physics (KICP), The University of Chicago, USA.

Visiting Postdoctoral Fellow, May-September 2008.

Collaboration with Prof. Edward W. Kolb.

Department of Astronomy and Astrophysics, The University of Chicago, USA.

Visiting Ph.D. Student, January-December 2007.

Collaboration with Prof. Edward W. Kolb.

International Collaborations

- PI of the LSST Brazilian Participation Group and member of LSST [Dark Energy Science Collaboration](#), 2019 – present day.
- Full member of the [J-PLUS](#) collaboration, 2019 – present day.
- Full member of the [J-PAS](#) collaboration, 2014 – present day. Coordinator of the “Large Scale Structure” Science Working Group, 2018 – present day.
- Full member of the [Euclid Consortium](#), 2013 – 2014. External collaborator, 2014 – present day (change due to the present non-European affiliation). Coordinator of the Work Package 5 “Deviations from Homogeneity and Isotropy” of the Theory Science Working Group between 2013 – 2017.

Professional Service

- Head of the [UFES undergraduate distance-learning course in Physics](#), March 2018 – August 2020.
- Member of the PhD program [PPGCosmo](#).
- Member of the Master and PhD program [PPGFis](#).
- [INAF](#) (National Institute for Astrophysics) associate, Trieste division, 2020 – present day.
- [INFN](#) (National Institute of Nuclear Physics) associate, Padova division, 2005 — 2008.

Italian National Scientific Qualification

- Competition sector 02/A2 (theoretical physics of fundamental interactions), fascia I (full professor). Valid from September 4, 2019 to September 4, 2028.
- Competition sector 02/A2 (theoretical physics of fundamental interactions), fascia II (associate professor). Valid from September 4, 2019 to September 4, 2028.
- Competition sector 02/C1 (astronomy, astrophysics, Earth and planetary physics), fascia II (associate professor). Valid from September 2, 2019 to September 2, 2028.

Grants and Awards (last 5 years, won as proponent)

- 2020 – present day, over 2.5 million CPU hours at the Italian and Brazilian Tier-0 supercomputers.
- 2020 – 2022, Marie Skłodowska-Curie fellowship of the call H2020-MSCA-IF-2019 (€137.605).
- 2016 – present day, [FAPES](#): “Apoio à organização de eventos” (R\$13,000), “Apoio à participação em eventos” (R\$7,544), “Apoio à organização de eventos” (R\$11,500), Universal (R\$14,580).
- 2016 – present day, [CNPq](#): “Produtividade em Pesquisa” fellowship (R\$79,200), APV (R\$5,000), Universal (R\$21,000), “Auxílio à Promoção de Eventos Científicos” (R\$16,000).

Reviewer for the funding agencies:

- *Agencia Nacional de Investigación y Desarrollo*, Chile. 2021 – ongoing.
- *Narodowe Centrum Nauki*, Poland. 2019 – ongoing.
- *Marsden Fund*, New Zealand. 2019 – ongoing.
- *Conselho Nacional de Desenvolvimento Científico e Tecnológico*, Brazil. 2018 – ongoing.
- *Fundação de Amparo à Pesquisa e Inovação do Espírito Santo*, Brazil. 2018 – ongoing.

Teaching

Teacher, Federal University of Espírito Santo, Brazil

Graduate courses in Physics (60 hours, 4h per week, 1 semester, equivalent to approximately 8 CFU):

- Bayesian Inference (2016-1, 2017-2, 2019-1)
- General Relativity (2016-2)

Undergraduate courses in Physics (60 hours, 4h per week, 1 semester, equivalent to approximately 8 CFU):

- Electromagnetism (2015-1, 2017-1)
- Astrophysics (2019-2)
- Modern Physics I (2015-2, 2018-2, 2022-1)
- Modern Physics II (2022-1)
- Special Relativity (2015-2)
- General Relativity (2016-1, 2016-2, 2020-1)
- Statistical Physics (2017-1)
- Condensed Matter (2015-1)

Undergraduate distance-learning courses in Physics (15 weeks, 2h sync. + 2h async. per week, 1 semester):

- Mechanics (2017-1)
- Statistics (2018-1)
- Calculus I (2017-2)
- Calculus II (2017-2)
- Electromagnetism (2018-1, 2019-1, 2020-1)

Teaching Assistant, Heidelberg University, Germany

Undergraduate courses in Physics (2h per week, 1 semester):

- General Relativity (2012-1)
- Computational Statistics (2013-1)
- Cosmology (2013-2)

Teaching Assistant, University of Jyväskylä, Finland

Undergraduate courses in Physics (2h per week, 1 semester):

- Cosmology (2010-1)

Advising

PhD students (supervisor):

- Ranier Menote (ongoing – PPGCosmo/UFES, Brazil)
- David Francisco Camarena Torres (ongoing – PPGCosmo/UFES, Brazil)
- Rodrigo Duarte Silva (ongoing – PPGFis/UFES, Brazil)
- Tássia Andrade Ferreira (2021 – PPGCosmo/UFES, Brazil)
- Pedro Otávio Souza Baqui (2020 – PPGFis/UFES, Brazil)
- Eddy Giusepe Chirinos Isidro (2019 – PPGFis/UFES, Brazil)

PhD students (co-supervisor):

- Mikko Pääkkönen (2014 – University of Jyväskylä, Finland – supervisor: Kimmo Kainulainen)

Master students (supervisor):

- Ranier Menote (2021 – PPGFis/UFES, Brazil)
- David Camarena Torres (2018 – PPGFis/UFES, Brazil)
- Rodrigo Duarte Silva (2018 – PPGFis/UFES, Brazil)
- Ingrid Ferreira da Costa (2018 – PPGFis/UFES, Brazil)

Master students (co-supervisor):

- Alexandre Posada (2013 – Heidelberg University, Germany – supervisor: Luca Amendola)
- Caroline Heneka (2013 – Heidelberg University, Germany – supervisor: Luca Amendola)
- Mikko Pääkkönen (2010 – University of Jyväskylä, Finland – supervisor: Kimmo Kainulainen)

Undergraduate students (supervisor):

- Guilherme Fracalossi (ongoing – DFIS/UFES, Brazil)
- Ana Paula Jeakel (2019 – DFIS/UFES, Brazil)
- Elisa Dardengo Mendes Glória (2019 – DFIS/UFES, Brazil)
- Maikon Barbosa de Araujo (2017 – DFIS/UFES, Brazil)
- Vitor Leandro Pinto (2016 – DFIS/UFES, Brazil)

Scientific Meetings

Organization of scientific events

1. *Cosmo22*, Rio de Janeiro, RJ, Brazil. September 5-9, 2022.
2. *V José Plínio Baptista School of Cosmology*, Pedra Azul, ES, Brazil. October, 2021.
3. *PPGCosmo workshop*, Vitória, ES, Brazil. March 5-6, 2020.
4. *Gravitational Wave Challenges And Cosmology*, Natal, RN, Brazil. June 3-14, 2019.
5. *Verão Quântico 2019*, Ubu, Anchieta, ES, Brazil. February 17-22, 2019.
6. *IV José Plínio Baptista School of Cosmology*, Pedra Azul, ES, Brazil. October 15-19, 2018.
7. *XXXIX National Meeting on Particles and Fields* of the Brazilian Physical Society, Campos do Jordão, SP, Brazil. September 24-28, 2018.
8. *Inverno Astrofísico 2018*, Castelo, ES, Brazil. July 22-29, 2018.
9. *Interactions in the dark sector of the universe*, Santa Teresa, ES, Brazil. June 3-6, 2018.
10. *XXXVIII National Meeting on Particles and Fields* of the Brazilian Physical Society, Passa Quatro, MG, Brazil. September 18-22, 2017.
11. *III José Plínio Baptista School of Cosmology*, Pedra Azul, ES, Brazil. September 25-30, 2016.
12. *Black Holes and their Analogues*, Ubu-Anchieta, ES, Brazil. April 13-17, 2015.
13. *Seventh TRR33 Winter School*, Passo del Tonale, Italy, December 1-6, 2013.
14. *Sixth TRR33 Winter School*, Passo del Tonale, Italy, December 9-14, 2012.
15. *Fifth TRR33 Winter School*, Passo del Tonale, Italy, December 4-9, 2011.
16. *Workshop: Inhomogeneous Cosmologies*, Jyväskylä, Finland, August 15-19, 2011.

Conferences (speaker)

1. *Reuven Opher Workshop on Challenges of New Physics in Space*, Brazil, December 13, 2021.
Invited talk: “The Copernican principle in light of the latest cosmological data”.
2. *LSST Brazil 2021*, Brazil, December 8, 2021.
Invited talk: “Cosmology with LSST Type Ia Supernovae”.
3. *CosmoBR*, Guarapari (ES), Brazil, December 8, 2021.
Invited talk: “Tensões no modelo padrão da cosmologia”.
4. *PPGCosmo workshop*, Vitória (ES), Brazil, 5-6/3/2020. Invited talk: “The Hubble-constant crisis”.
5. *XL Encontro Nacional de Física de Partículas e Campos*, Campos do Jordão (SP), Brazil, September 1-5, 2019. Invited talk: “Model independent analyses in cosmology”.
6. *II South American Dark Matter Workshop*, São Paulo (SP), Brazil, November 21-23, 2018.
Conference talk: “No fundamental acceleration scale in disk galaxies”.
7. *The Dark Energy Revolution in Cosmology*, Rio de Janeiro (RJ), Brazil, September 28, 2018.
Invited talk: “No fundamental acceleration scale in disk galaxies”.
8. *IV CosmoSul*, ICTP-SAIFR, São Paulo (SP), Brazil, July 31 – August 2, 2017.
Invited talk: “Clustering dark energy and halo abundances”.
9. *12th J-PAS Meeting*, CBPF, Rio de Janeiro (RJ), Brazil, April 11, 2016.
Invited talk: “Testing homogeneity and isotropy with J-PAS”.
10. *VIth workshop challenges of new physics in space*, Campos do Jordão, SP, Brazil. May 24-29, 2015.
Invited talk: “Lensing of point sources”.
11. *Verão Quântico*, João Pessoa, PB, Brazil. February 23-27, 2015.
Invited talk: “Constraining perturbations with lensing of supernovae”.
12. *1º Workshop de Física Teórica do IFES*, IFES-Cariacica, Cariacica (ES), Brazil, December 19, 2014.
Invited opening talk: “Observational Cosmology and the Euclid Mission”.
13. *2a Reunião Carioca de Cosmologia e Gravitação*, Rio de Janeiro State University (UERJ), Brazil, April 3-4, 2014. Invited talk: “Cosmology with SNe: signals and biases”.
14. *The Quest for Dark Energy*, Ringberg Castle, Germany, June 24-29, 2012.
Invited talk: “Systematic search for systematic bias in SN Ia data”.
15. *Workshop: Inhomogeneous Cosmologies*, Jyväskylä, Finland, August 15-19, 2011.
Invited talk: “Gravitational lensing with the sGL method”.
16. *Finnish Cosmophysics Meeting*, Tampere, Finland, April 20-21, 2011.
Invited talk: “Gravitational lensing with the sGL method”.
17. *45th Rencontres de Moriond, Cosmology Session*, La Thuile, Italy, March 13-20, 2010.
Conference talk: “Gravitational lensing and parameter extraction from SNe catalogues”.
18. *Λ -LTB Cosmology*, KEK, Tsukuba, Japan, October 20-23, 2009.
Invited talk: “Toy models for the inhomogeneous universe”.
19. *Invisible Universe International Conference*, Palais de l’UNESCO, Paris, France, June 29-July 3, 2009. Conference talk: “Impact of cosmic inhomogeneities on observations”.
20. *SIGRAV School in Cosmology*, GGI, Firenze, Italy, January 26-29, 2009.
Conference talk: “Cosmological background solutions and cosmological backreactions”.
21. *43rd Rencontres de Moriond, Cosmology Session*, La Thuile, Italy, March 15-22, 2008.
Conference talk: “On cosmological observables in a swiss-cheese universe”.
22. *Les Houches Summer School (Session LXXXIV) on Particle Physics Beyond The Standard Model*, Les Houches, France, August 1-26, 2005.
Title of the talk: “Cosmological evolution of alpha driven by a general coupling with quintessence”.

Invited Institute Seminars

1. Università degli Studi dell'Insubria, Como, Italy, March 29, 2022.
Seminar: "ALTB N-body simulations cosmology beyond homogeneity and isotropy".
2. Instituto Nacional de Pesquisas Espaciais, São José dos Campos (SP), Brazil, August 24, 2021.
Seminar: "A possible solution to the Hubble-constant crisis".
3. SNOWMASS, August 24, 2021. Seminar: "The M_B tension".
4. International Institute of Physics, Natal (RN), Brazil, June 23, 2021.
Seminar: "A possible solution to the H0 crisis".
5. Sharif University of Technology, Tehran, Iran, March 2, 2021.
Seminar: "The Hubble-constant crisis".
6. Institute for Theoretical Physics, Heidelberg, Germany, December 1, 2020.
Seminar: "The Hubble-constant crisis".
7. Institute for Fundamental Physics of the Universe, Trieste, Italy, October 2, 2020.
Seminar: "The Hubble-constant crisis".
8. Donostia International Physics Center, Spain, February 17, 2020.
Seminar: "A fundamental test for MOND".
9. IF-UFRJ, Brazil, October 10, 2019. Colloquium: "The Hubble-constant crisis".
10. Padova University, Padova, Italy, February 21, 2019.
Theory seminar: "Absence of a fundamental acceleration scale in galaxies".
11. Universidad de Chile, Santiago, Chile, November 17, 2017.
Theory seminar: "Clustering dark energy and halo abundances".
12. ICTP-SAIJR, São Paulo (SP), Brazil, July 6, 2016.
Theory seminar: "Constraining the halo mass function with observations".
13. National Observatory, Rio de Janeiro (RJ), Brazil, February 24, 2016.
Theory seminar: "Testing homogeneity and isotropy with J-PAS".
14. UFES, Vitória (ES), Brazil, June 26, 2015.
Theory seminar: "Coupling dark energy to dark matter inhomogeneities".
15. National Observatory, Rio de Janeiro (RJ), Brazil, August 20, 2014.
Theory seminar: "Signal and noise from lensing of point sources".
16. Astronomy Unit, Queen Mary University of London, England, July 7, 2014.
Theory seminar: "Lensing of point sources, inhomogeneous cosmology and robustness".
17. Physics Institute, São Paulo University, Brazil, May 19, 2014.
Theory seminar: "Cosmological information and bias from lensing of point sources".
18. Institute for Theoretical Physics, Heidelberg University, Germany, March 12, 2014.
Theory seminar: "so long, and thanks for all the Physik".
19. Physics Institute, University of Bonn, Germany, February 11, 2014.
Theory seminar: "Supernova cosmology: signals and biases".
20. LUTH, Observatoire de Paris, France, June 5, 2013.
Theory seminar: "Cosmological information from lensing of standard candles".
21. Department of Physics, University of Jyväskylä, Finland, March 5, 2010.
Theory seminar: "Modeling inhomogeneities in the universe".

22. Institute for Theoretical Physics, Heidelberg University, Germany, October 7, 2009.
Theory seminar: “Toy models for the inhomogeneous universe”.
23. Department of Physics, University of Jyväskylä, Finland, November 13, 2008.
Theory seminar: “Cosmological background solutions and cosmological backreactions”.

Outreach

Organization

1. *Universo no Parque*, Vitória, ES, Brazil. 2017 – ongoing. General-audience seminars in the parks of Vitória, with topics ranging from astronomy to physics.
2. *Universo no Escola*, Vitória, ES, Brazil. 2017 – ongoing. General-audience seminars in the public high schools of Vitória, with topics ranging from astronomy to physics.

Seminars

1. Seminar on cosmology at the elementary school “Elio de Morpurgo”, Trieste, Italy, October 21, 2021.
2. *NEXT*, Trieste, Italy, September 25-26, 2021. VR Headset simulations and seminar.
3. *Pint of Science*, Trieste, Italy, September 14, 2021.
4. 100 Anos do Eclipse de Sobral, UFES, Vitória (ES), Brazil, May 29-30, 2019.
Title: “Cosmologia Moderna e Futura”.
5. Parque Botânico Vale, Vitória, ES, Brazil, May 13, 2018.
Title: “O Brasil verá quase toda as galáxias observáveis!”.
6. Escola Duarte Rabelo, Vitória, ES, Brazil, June 22, 2018.
Title: “O Brasil verá quase toda as galáxias observáveis!”.
7. Parque da Pedra da Cebola, Vitória, ES, Brazil, October 1, 2017.
Title: “O Brasil verá quase toda as galáxias observáveis!”.
8. Seminari dell’Accademia della Marca Trevigiana, Roncade, TV, Italy, December 23, 2016.
Title: “Le galassie dell’universo osservabile”.

Publications

I have published in the journal *Philosophy and Cosmology* the following short story:

Understanding Our Only Universe

Abstract: *In an imaginary dialogue between a professor and a layman about the future of cosmology, the said professor relates the paradoxical story of scientist Zee Prime, a bold thinker of a future civilization, stuck in a lonely galaxy, forever unaware of the larger universe. Zee Prime comes to acknowledge his position and shows how important it is to question standard models and status quo, as only the most imaginative ideas give us the chance to understand what he calls “our only universe” – the special place and time in which we live.*

Valerio Marra

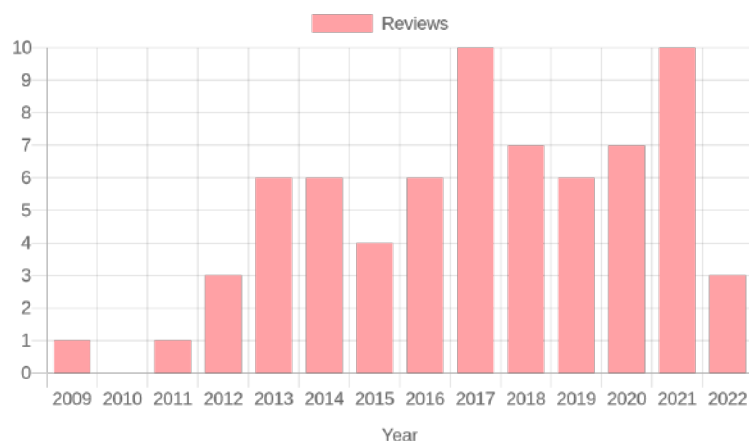
<https://publons.com/researcher/H-3974-2012/>

Web of Science ResearcherID: [H-3974-2012](#)

ORCID: 0000-0002-7773-1579

Verified reviews

REVIEW SUMMARY



REVIEWER SUMMARY

(32) Physical Review D	WOS	(7) Physics of the Dark Universe	WOS
(7) Journal of Cosmology and Astroparticl...	WOS	(4) Monthly Notices of the Royal Astronom...	WOS
(3) Classical and Quantum Gravity	WOS	(2) The European Physical Journal C	WOS
(2) General Relativity and Gravitation	WOS	(2) Physical Review Letters	WOS
(2) Physics Letters B	WOS	(1) EPL (Europhysics Letters)	WOS
(1) Modern Physics Letters A	WOS	(1) The Astrophysical Journal	WOS
(1) Palgrave Communications	WOS	(1) Proceedings of the Royal Society A: Ma...	WOS
(1) Aeronautics and Aerospace Open Access Jour...	WOS	(1) Advances in High Energy Physics	WOS
(1) Universe	WOS	(1) International Journal of Modern Physic...	WOS

Valerio MARRA – Publications

April 11, 2022

I am author of 67 Refereed Publications in the fields of cosmology and astrophysics, of which 53 with less than 8 authors. According to [Web of Science](#), I have 2000+ citations and my h-index is 23. According to [inSPIRE](#), I have 2900+ citations and my h-index is 29. I have 7 papers [\[39, 53, 54, 57, 63, 64, 70\]](#) with 100+ citations and 7 papers [\[12, 18, 24, 41, 47, 49, 50\]](#) with 50–100 citations.

I published 1 paper in *Nature Astronomy* [\[24\]](#), 2 papers in *Physical Review Letters* [\[48, 39\]](#), 1 paper in *Physical Review D Letters* [\[10\]](#) and 1 paper in *Monthly Notices of the Royal Astronomical Society Letters* [\[41\]](#).

Regarding my 14 collaboration papers:

- I contributed to Sections IV and VII of the Snowmass 2021 review [\[58\]](#), as stated at the beginning of those Sections.
- I contributed to the overall development of the Euclid paper [\[59\]](#) and, in particular, to the part on the ALTB model.
- I signed the Letter of Interest [\[62, 63, 64, 65\]](#) because I was invited to participate in Snowmass 2021 thanks to my works on the Hubble-constant tension.
- I signed [\[1, 61, 60, 67, 68\]](#) because I was awarded the J-PAS “PathFinder Infrastructure Team” award.
- I share first authorship of the J-PAS paper [\[69\]](#).
- I contributed substantially to Section 4.2 “Value-added catalogues” and Section 6.3 “Large scale structure” of the presentation paper of the miniJPAS survey [\[66\]](#).
- I contributed to Section IV.3 “Beyond homogeneity and isotropy” of the Euclid review paper [\[70\]](#).

I am also author of 5 Refereed Publications in other fields [\[71, 72, 73, 74, 75\]](#), mostly on data analysis.

Publications under Review

- [1] Martínez-Solaesche *et al.*, *The miniJPAS survey: Identification and characterization of the emission line galaxies down to $z < 0.35$ in the AEGIS field*, [arXiv:2204.01698](#) [\[astro-ph.GA\]](#).
- [2] V. Marra, T. Castro, D. Camarena, S. Borgani, and A. Ragagnin, *The BEHOMO project: ALTB N -body simulations*, [arXiv:2203.04009](#) [\[astro-ph.CO\]](#).
- [3] T. Ferreira and V. Marra, *A fast and reliable method for the comparison of covariance matrices*, [arXiv:2107.04211](#) [\[astro-ph.CO\]](#).

Refereed Publications

- [4] R. Menote and V. Marra, *Baryon acoustic oscillations in thin redshift shells from BOSS DR12 and eBOSS DR16 galaxies*, *Mon. Not. Roy. Astron. Soc.* **in press** (2022) , [arXiv:2112.10000](#) [[astro-ph.CO](#)].
- [5] H. Steigerwald, V. Marra, and S. Profumo, *Revisiting constraints on asymmetric dark matter from collapse in white dwarf stars*, *Phys.Rev. D* (2022) , [arXiv:2203.09054](#) [[astro-ph.CO](#)].
- [6] G. Alestas, D. Camarena, E. Di Valentino, L. Kazantzidis, V. Marra, S. Nesseris, and L. Perivolaropoulos, *Late-transition versus smooth $H(z)$ -deformation models for the resolution of the Hubble crisis*, *Phys.Rev. D***105** (2022) 063538, [arXiv:2110.04336](#) [[astro-ph.CO](#)].
- [7] H. Leandro, V. Marra, and R. Sturani, *Measuring the Hubble constant with black sirens*, *Phys.Rev. D***105** (2022) 023523, [arXiv:2109.07537](#) [[gr-qc](#)].
- [8] H. Steigerwald, D. Rodrigues, S. Profumo, and V. Marra, *Type Ia Supernova Magnitude Step from the local Dark Matter Environment*, *Mon. Not. Roy. Astron. Soc.* **510** (2022) 4779–4795, [arXiv:2112.09739](#) [[astro-ph.CO](#)].
- [9] D. Camarena, V. Marra, Z. Sakr, and C. Clarkson, *The Copernican principle in light of the latest cosmological data*, *Mon. Not. Roy. Astron. Soc.* **509** (2022) 1291–1302, [arXiv:2107.02296](#) [[astro-ph.CO](#)].
- [10] V. Marra and L. Perivolaropoulos, *A rapid transition of G_{eff} at $z_t \simeq 0.01$ as a solution of the Hubble and growth tensions*, *Phys.Rev. D***104** (2021) L021303, [arXiv:2102.06012](#) [[astro-ph.CO](#)].
- [11] R. von Marttens, J. E. Gonzalez, J. Alcaniz, V. Marra, and L. Casarini, *Model-independent reconstruction of dark sector interactions*, *Phys.Rev. D***104** (2021) 043515, [arXiv:2011.10846](#) [[astro-ph.CO](#)].
- [12] D. Camarena and V. Marra, *On the use of the local prior on the absolute magnitude of Type Ia supernovae in cosmological inference*, *Mon. Not. Roy. Astron. Soc.* **504** (2021) 5164–5171, [arXiv:2101.08641](#) [[astro-ph.CO](#)].
- [13] T. Castro, S. Borgani, K. Dolag, V. Marra, M. Quartin, A. Saro, and E. Sefusatti, *On the impact of baryons on the halo mass function, bias, and cluster cosmology*, *Mon. Not. Roy. Astron. Soc.* **500** (2021) 2316–2335, [arXiv:2009.01775](#) [[astro-ph.CO](#)].
- [14] V. Marra, D. C. Rodrigues, and A. O. de Almeida, *A fundamental test for MOND*, *Mon. Not. Roy. Astron. Soc.* **494** (2020) 2875–2885, [arXiv:2002.03946](#) [[astro-ph.GA](#)].
- [15] D. Camarena and V. Marra, *A new method to build the (inverse) distance ladder*, *Mon. Not. Roy. Astron. Soc.* **495** (2020) 2630–2644, [arXiv:1910.14125](#) [[astro-ph.CO](#)].
- [16] D. C. Rodrigues, V. Marra, A. Del Popolo, and Z. Davari, *Reply to: Overconfidence in Bayesian analyses of galaxy rotation curves*, *Nat. Astron.* **4** (2020) no. 2, 134–135, [arXiv:2002.01970](#) [[astro-ph.GA](#)].
- [17] R. von Marttens, L. Lombriser, M. Kunz, V. Marra, L. Casarini, and J. Alcaniz, *Dark degeneracy I: Dynamical or interacting dark energy?*, *Phys. Dark Univ.***28**,100490 (2020) , [arXiv:1911.02618](#) [[astro-ph.CO](#)].
- [18] D. Camarena and V. Marra, *Local determination of the Hubble constant and the deceleration parameter*, *Phys.Rev.Res.* **2** (2020) no. 1, 013028, [arXiv:1906.11814](#) [[astro-ph.CO](#)].
- [19] Z. Davari, V. Marra, and M. Malekjani, *Cosmological constraints on minimally and non-minimally coupled scalar field models*, *Mon. Not. Roy. Astron. Soc.* **491** (2020) 1920–1933, [arXiv:1911.00209](#) [[gr-qc](#)].
- [20] V. Marra and E. G. C. Isidro, *A first model-independent radial BAO constraint from the final BOSS sample*, *Mon. Not. Roy. Astron. Soc.* **487** (2019) 3419–3426, [arXiv:1808.10695](#) [[astro-ph.CO](#)].

- [21] R. von Marttens, V. Marra, L. Casarini, J. E. Gonzalez, and J. Alcaniz, *Null test for interactions in the dark sector*, *Phys.Rev.* **D99** (2019) no. 4, 043521, [arXiv:1812.02333 \[astro-ph.CO\]](#).
- [22] D. C. Rodrigues, V. Marra, A. Del Popolo, and Z. Davari, *Reply to “Presence of a fundamental acceleration scale in galaxies” and “A common Milgromian acceleration scale in nature”*, *Nat. Astron.* **2** (2018) no. 12, 927–929, [arXiv:1811.05882 \[astro-ph.GA\]](#).
- [23] D. Camarena and V. Marra, *The impact of the cosmic variance on H_0 on cosmological analyses*, *Phys.Rev.* **D98** (2018) 023537, [arXiv:1805.09900 \[astro-ph.CO\]](#).
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Refereed Collaboration Papers

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- [71] V. Marra and M. Quartin, *A Bayesian estimate of the early COVID-19 infection fatality ratio in Brazil based on a random seroprevalence survey*, **International Journal of Infectious Diseases** **111** (2021) 190–195.
- [72] Baqui, Pedro and Marra, Valerio and Alaa, Ahmed M. and Bica, Ioana and Ercole, Ari and van der Schaar, Mihaela, *Comparing COVID-19 risk factors in Brazil using machine learning: the importance of socioeconomic, demographic and structural factors*, **Scientific Reports** **11** (2021) 15591.
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- [74] L. Amendola, V. Marra, and M. Quartin, *The evolving perception of controversial movies*, **Palgrave Communications** **1** (2015) 15038, [arXiv:1512.07893 \[physics.soc-ph\]](#).

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- [75] V. Marra, *Understanding Our Only Universe*, Philosophy and Cosmology **19** (2017) 50–54.
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Publications in Conference Proceedings

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Publications

PUBLICATION METRICS

For all time

TOTAL TIMES CITED

2078

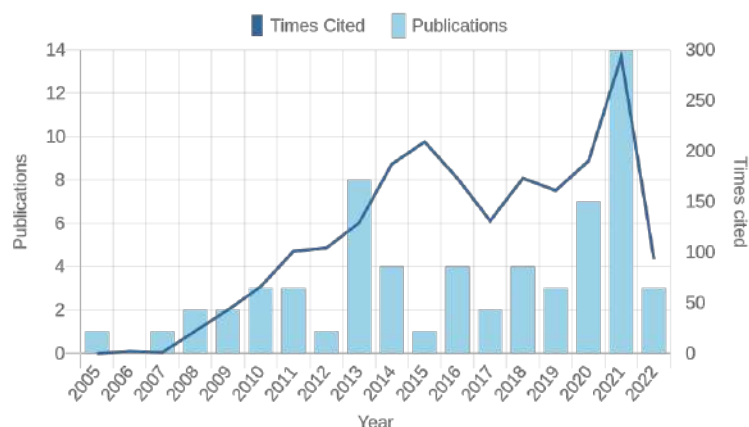
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PUBLICATIONS

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PUBLICATION IMPACT OVER TIME



PUBLISHING SUMMARY

(17) Physical Review D

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(9) Journal of Cosmology and Astroparticl...

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(4) Astronomy & Astrophysics

WOS

(3) Physics of the Dark Universe

WOS

(1) Living Reviews in Relativity

WOS

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(4) Nature Astronomy

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(2) Physical Review Letters

WOS

(1) The European Physical Journal C

WOS

(1) General Relativity and Gravitation

WOS

(1) Physical Review Research

WOS

Curriculum Vitæ et Studiorum

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Current Affiliation : “*Maria Zambrano*” *Distinguished Researcher*,
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Place and Date of Birth : Roma (Italy), August 27th, 1977

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Education :

2002-05 : Ph.D. in Theoretical Physics at the University of Rome “Roma Tre”, Rome, IT. Date: March 3, 2005.

Title of Ph.D. Thesis:

“Symmetry and Dynamics:

Mathematical Topics in 5-Dimensional Deformed Relativity”.

Supervisor: Prof. R. Mignani.

1996-2001 : Laurea Degree in Theoretical Physics at the University of Rome “Roma Tre”, Rome, IT. Date: October 31, 2001.

Final mark: 110/110 *cum laude*.

Title of Laurea Thesis: *“Killing Symmetries of Generalized Minkowski Spaces”.*

Supervisor: Prof. R. Mignani.

1991-96 : Maturità Scientifica Degree.

Scientific Lyceum F. Enriques, Ostia Lido, Rome, IT.

Final mark: 60/60 *with Honors*.

Short Thesis on Relativity, Big Bang and Black Holes.

Scientific Visits :

2019 (Nov. - Dec.) : Visiting Professor, Instituto de Física Teórica, Universidad de Murcia, Spain.

2019 (1 visit) : INRNE, Bulgarian Academy of Science, Sofia, Bulgaria.

2018 (1 visit) : Dept. of Mathematics, University of Trento, Italy.

2018 (1 visit) : Nordita (Nordic Institute for Theoretical Physics), Stockholm, Sweden.

2018 (1 visit) : Physics Dept., Univ. of Calabria, Cosenza, Italy.

2017 (1 visit) : Mathematical Institute, Oxford, UK.

2018, 2017 (Sep. - Dec.) : Jiménez de la Espada Fellow, Theoretical Physics Group, University of Murcia, Spain.

2017 (1 visit) : Department of Applied Mathematics and Theoretical Physics (DAMTP), University of Cambridge, UK.

2017 - 2018 (2 visits) : Theoretical Physics Group, PUCV, Valparaiso, Chile.

2016 - 2018 (3 visits) : Theoretical Physics Group, Dublin Institute for Advanced Studies (DIAS), Dublin, Ireland.

2015 - 2016 (several visits) : Mathematics Dept., University of Bologna, Bologna, Italy.

2016 - 2009 (several visits) : Physics Dept. of State University, Milano, Italy.

2015 - 2009 (3 visits) : IPhT - CEA, Saclay (Paris), France.

2015 - 2009 (7 visits) : Physics Dept., Imperial College, London, UK.

2015 -2013 (2 visits) : IFT, UAM - CSIC, Madrid, Spain.

2016 - 2012 (several visits) : DISAT, Insubria University, Como, Italy; DISIT, Piemonte Orientale University, Alessandria, Italy; Theoretical Physics Dept., Torino University, Italy; Physics Dept., Ferrara University, Italy; Physics Dept., Genova Univ., Italy.

2011 -2012 (2 visits) : Physics Dept., UCB, Berkeley, CA, USA.

2016 - 2006 (several visits) : Physics Dept., Theory Division, CERN, Switzerland.

2016 - 2009 (6 visits) : Mathematics Dept. of State University, Milano, Italy.

2013 - 2009 (3 visits) : Physics Dept., Polytechnic of Torino, Italy.

2010 - 2009 (2 visits) : Mathematics Dept., King's College, London, UK.

2007, 2009-2012 (6 visits) : Department of Physics and Astronomy, UCLA, Los Angeles, CA, USA.

Research Topics : [in inverse chronological order]

- Study and classification of non-compact, real forms of maximal reductive subalgebras in simple Lie algebras, with analysis of their relevance in application to high-energy theoretical physics (with W. A. De Graaf).
- Study of Kac-Moody algebras, Borcherds algebras and their super-generalizations, as well as of exceptional Lie algebras, by focussing on their inner Jordan pair structure, and related generalizations such as Vinberg T-algebras, Magic Star algebras and Exceptional Periodicity, with special emphasis on applications in physics, especially in cosmology and particle physics (with M. Rios and P. Truini).
- Study of spinor varieties in characteristic two, in particular in relation to Freudenthal triple systems (with B. Van Geemen).
- Study of (conical) affine and projective special Kaehler geometry and related special real and HyperKaehler/quaternionic geometry (through R-map and c-map), with particular emphasis on algebraic aspects, such as the structure of the rings of invariants of global isometries, and related applications to physics (e.g., black branes classification and entropy) (with D. Alekseevsky, A. Spiro).
- Study and classification of the metric structure of open orbits of global isometries in projective special real and special Kaehler geometry, with particular emphasis to the relation to various classes of prehomogeneous vector spaces associated to the so-called algebras "of type e_7 " and "of type e_6 ", to cubic Jordan algebras and Freudenthal triple systems, and to their applications in physics (with V. Cortes).
- In the context of the generalization of special real geometry, study of the geometric structures arising in certain components of level sets of higher degree homogeneous polynomials and functions, with possible realizations of conformal and quasi-conformal global symmetries (with V. Cortes, D. Lindemann).

- Study of the double-copy structure of (super) gravity in various dimensions, with particular emphasis on the origin of gravitational symmetries and electric-magnetic dualities from the gauge groups of (super)Yang-Mills theories (with A. Anastasiou, L. Borsten, M. J. Duff, M. J. Hughes, S. Nagy, M. Zoccali).
- Study of representations of Clifford algebras and Spin coverings of the Lorentz group in various signatures and dimensions, with particular emphasis on the use of division or split algebras in the classification of the corresponding orbit stratification. Application to the maximally supersymmetric supergravity theories in 11 dimensions, beyond M-theory (namely, M'-theory and M*-theory) (with A. Santi).
- Study, characterization and classification of Jordan and Kantor triple systems, especially in relation to the generalization of Jordan algebras and Freudenthal triple systems. Investigation of the relation with Lie algebras through the Tits-Koecher-Kantor procedure, and with homogeneous and/or symmetric manifolds and their geometric properties (with N. Cantarini, E. Latini, A. Ricciardo, A. Santi).
- Study and classification of maximal parabolic subalgebras of exceptional Lie algebras, and their interpretation in terms of symmetries of Jordan algebras and (extended) Freudenthal triple systems (with V. K. Dobrev).
- Study of the extended Vogel plane, and its relation to Jordan algebras, Freudenthal triple systems, and their symmetries (with B. W. Westbury).
- Definition and study of lower-dimensional super-Calabi-Yau manifolds, and formulation of generalized mirror symmetry (also in relation to the peculiar sub-class of rigid Calabi-Yau's) (with S. L. Cacciatori, F. Dalla Piazza, S. Noja, R. Re).
- Study of superspaces and their quantization in various signatures and dimensions, and of their relations with split algebras and Jordan algebras, also by means of quantum group theoretical techniques (with R. Fiorese, E. Latini).
- Study of non-linear, non-associative structures in gauge theories, in particular related to division algebras, Jordan and Freudenthal triple systems, and investigation of their interplay with global or local supersymmetry and conformal symmetry (with L. Borsten, M.J.Duff, J. J. Fernandez-Melgarejo, S. Ferrara, C. Furey, C.-X. Qiu, S.-Y. D. Shih, A. Tagliaferro, E. Torrente-Lujan, B. Zumino).
- Study of the phase transitions in asymptotically non-flat extremal black holes, non-linearly coupled to Stueckelberg scalar fields, with applications to the AdS/CFT and AdS/CMT correspondences (with O. Miskovic, P. Quezada Leon).
- Study of the quantum circuits and quantum gates in the context of the black-hole/qubit correspondence, with particular emphasis on orbit transmutation and entanglement generation by means of suitable symplectic transformations (with T. Prudencio, D. J. Cirilo-Lombardo).
- Study of non-linear symmetries in theories of gravity, with application to asymptotically AdS black holes, their geometry, physics and attractor dynamics in gauged supergravity theories, and to their relevance within AdS/CFT correspondence (with D. Klemm, T. Mandal, N. Petri, M. Rabbiosi, C. Santoli, P.K. Tripathy).
- Study of *symplectic deformations* of gauged supergravity theories, and analysis of the properties of the resulting vacua, by exploiting group-theoretical methods in flux compactifications of superstring theory (with G. Dall'Agata, G. Inverso).
- Study of *fermionic wiggling* (through anti-Killing spinor techniques) of solutions of supergravity theories in various dimensions, with particular attention to possible modifications of the attractor mechanism (with L. G. C. Gentile, P. A. Grassi, A. Mezzalana, W. A. Sabra).
- Study of standard and non-standard p -branes in gravity with (maximal and non-maximal) local supersymmetry in every dimension, with particular emphasis on their symmetries and on the structure of the corresponding *wrapping rules*, also in relation to “magic” non-supersymmetric theories in various dimensions (with E. A. Bergshoeff, G. Pradisi, F. Riccioni, L. Romano).

- Study of the correspondence between the mathematics of stringy black holes and the quantum entanglement, with applications to Quantum Information Theory (with M.J. Duff, L. Borsten, D. Dahanayake and W. Rubens).
- Application of entropy function formalism in flux compactifications of superstring theories, in order to classify the critical points of the effective gauge potential, and their supersymmetry breaking properties (with D. Cassani, S. Ferrara, F. Morales, H. Samtleben).
- Study of exceptional groups and their applications to supergravity, multi-center black hole physics and supersymmetry (with S. L. Cacciatori, B. L. Cerchiai, S. Ferrara, E. Orazi, F. Riccioni, B. van Geemen).
- Study of non-minimal curvature couplings, their embedding in Superconformal Supergravity, and applications to cosmological inflationary models within (and beyond) $(N)MSSM$, both in Jordan and Einstein frames (with S. Ferrara, R. Kallosh, A. Linde, A. Van Proeyen).
- Study of the Attractor Mechanism in single-center and multi-center space-time singularities, in Supergravity and Superstring theories in various dimensions (with L. Andrianopoli, P. Aschieri, S. Bellucci, L. Borsten, S. L. Cacciatori, B. L. Cerchiai, A. Ceresole, R. D'Auria, D. Dahanayake, M. J. Duff, S. Ferrara, A. Gnechchi, M. Günaydin, R. Kallosh, F. Morales, E. Orazi, W. Rubens, H. Samtleben, A. Shcherbakov, R. Stora, M. Trigiante, A. Yeranyan, B. Zumino).
- Non-linear realizations of $\mathcal{N} = 8$ superconformal algebras, and related study of $\mathcal{N} = 8$ Superconformal Mechanics, also in the (bi-)harmonic superspace formulation (with S. Bellucci, S. Krivonos, E. Orazi).
- Study of Fayet-Ilioupoulos terms in $\mathcal{N} = 4$ Superconformal Mechanics, and search for “root actions” by bosonic dimensional reduction procedures (with S. Bellucci, S. Krivonos, E. Orazi).
- Study of spin-chain and integrability techniques in $\mathcal{N} = 4$ super-Yang-Mills gauge theory, within the framework of the AdS/CFT correspondence (with S. Bellucci, P.-Y. Casteill, J. F. Morales, C. Sochichiu).

Post-Doctoral Fellowships :

- Jan. 2022 - (present) : 7th Post-Doctoral Fellowship :** “*Maria Zambrano*” *Distinguished Researcher* supported by the European Comunion under the NextGenerationEU programme, at the Instituto de Física Teorica, Dep.to de Física, Universidad de Murcia, ES.
- Oct. 2018 - Sept. 2021 : 6th Post-Doctoral Fellowship :** *Senior Research Grant* supported by the Physics Museum and Research Center “*Enrico Fermi*”, Roma, IT (Prof. L. Pietronero President).
- Jan. 2015 - Dec. 2017 : 5th Post-Doctoral Fellowship :** *Senior Research Grant* supported by the Physics Museum and Research Center “*Enrico Fermi*”, Roma, IT (Prof. L. Cifarelli President).
- Dec. 2012 - Nov. 2014 : 4th Post-Doctoral Fellowship :** *Post-Doctoral Fellow* of the Institute for Theoretical Physics of KUL Leuven, BE.
- Dec. 2010 - Nov. 2012 : 3rd Post-Doctoral Fellowship :** *Fellow* of the Physics Theory Division of CERN, Geneva, CH.
- Nov. 2008- Nov. 2010 : 2nd Post-Doctoral Fellowship :** INFN Research Fellowship for Theoretical Physicists, Foreign Research Center : *Stanford Institute for Theoretical Physics*, Physics Department, Stanford, CA, USA. (Supervisor : Prof. R. Kallosh).
- Jan. 2006 - Nov. 2008 : 1st Post-Doctoral Fellowship :** *Junior Research Grant* supported by the Physics Museum and Research Center “*Enrico Fermi*”, Roma, IT (Prof. A. Zichichi President).

Appointments and Awards

- 2021** : **Abilitazione Scientifica Nazionale II Fascia (Assistant Professor)**, s.c. 01/A4 (Fisica Matematica), s.s.d. MAT/07 (Fisica Matematica) 31/05/2021 - 31/05/2030.
- 2019** : **Visiting Scientist**
Instituto de Física Teórica, Universidad de Murcia, ES, November - December.
- 2018** : **Abilitazione Scientifica Nazionale I Fascia (Full Professor)**, s.c. 02/A2 (Fisica Teorica delle Interazioni Fondamentali, s.s.d. FIS/02 (Fisica Teorica Modelli e Metodi Matematici), 16/11/2018 - 16/11/2024.
- 2017** : **Jiménez de la Espada Fellow**
Instituto de Física Teórica, Universidad de Murcia, ES, September - December.
- 2016** : **Visiting Scientist**
CERN Theory Division, September - October 2016.
- 2013** : **Abilitazione Scientifica Nazionale II Fascia (Assistant Professor)**, s.c. 02/A2 (Fisica Teorica delle Interazioni Fondamentali, s.s.d. FIS/02 (Fisica Teorica Modelli e Metodi Matematici), 08/01/2014 - 08/01/2020.
- 2013** : **Julian Schwinger Diploma**,
at the International School of Subnuclear Physics, 51st Course:
Reflections on the Next Step for LHC,
“Ettore Majorana” Foundation and Centre for Scientific Culture (EMFCSC),
June 24 - July 3, Erice, Italy.
- 2006** : **Young Graduate Student Award** by the Italian Physics Society, Turin, Italy, September 18, 2006.
- 2005** : **The Best Student Award**
at the International School of Subnuclear Physics, 43rd Course:
Towards New Milestones in our Quest to go Beyond the Standard Model,
“Ettore Majorana” Foundation and Centre for Scientific Culture (EMFCSC),
Erice, Italy, August 29 - September 7, 2005.
- 2002-2004** : *Research Grant* supported by *Italian Catholic University Centre* (CUC).
- 2002** : Mentioned *with Honors* in the International Award “*Ostia Mare di Roma*”, Roma, Italy.
- 2000** : “**Enrico Persico**” **Fellowship** by Accademia Nazionale dei Lincei, Roma, Italy.

Teaching Duties :

- 2021** : **Professore Incaricato** di Fisica FIS/01 - CFU 6, ore di lezione 42, Corso di Laurea in Tecnologie Innovative per i Beni Culturali (classe L-43), II semestre - Ascoli Piceno, University of Camerino, Camerino, Italy.
- Nov. 2013** : Tutoring Bachelor Project [2 students] “*Classical Spin : an Intrinsic Property of Extended Media*”, KU Leuven, Belgium.
- 2012-13** : Exercise Tutoring in the course “*Electroweak and Strong Interactions*” (Prof. A.Sevrin) [Graduate level, 15 students], KU Leuven, Belgium.
- 2004-05** : Teaching assistant in the course ***Theory of General Relativity*** (Prof. R.Mignani) [Graduate level, 13 students],
University of Rome “Roma Tre”, “*Edoardo Amaldi*” Physics Dept., Italy.

- 2004-05** : Teaching assistant in the course *Classical Electrodynamics and Special Relativity* (Prof. R.Mignani) [Graduate level, 22 students]:
lectures on “*Paradoxes in Special Relativity*”,
University of Rome “Roma Tre”, “*Edoardo Amaldi*” Physics Dept., Italy.
- 2002-03** : Teaching assistant in the course *Physics of NonLinear Systems* (Prof. O.Ragnisco) [Ph.D. level, 5 students]:
lectures on “*Classical Solitons in Field Theory*”,
University of Rome “Roma Tre”, “*Edoardo Amaldi*” Physics Dept., Italy.

Research Papers and Contributions to Proceedings

At April 19, 2022 : total number of citeable papers (on INSPIRES HEP) : **140** (**3,048** citations), h (Hirsch) index : **30**.

Research Papers (Preprints)

1. *Spontaneous Scalarization of Extremal Black Holes*, A. Marrani, O. Miskovic, P. Quezada Leon, [arXiv:2203.14388](#) [hep-th].
2. *Octonionic Planes and Real Forms of G_2 , F_4 and E_6* , D. Corradetti, A. Marrani, D. Chester, R. Aschheim, [arXiv:2203.02671](#) [math.RA].
3. *Non-BPS Black Branes in M-theory over Calabi-Yau Threefolds*, A. Marrani, A. Mishra, P.K. Tripathy, [arXiv:2202.06872](#) [hep-th].
4. *Conjugation Matters. Bioctonionic Veronese Vectors and Cayley-Rosenfeld Planes*, D. Corradetti, A. Marrani, D. Chester, R. Aschheim, [arXiv:2202.02050](#) [math-ph].
5. *Classification of four-rebit states*, H. Dietrich, W. A. de Graaf, A. Marrani, M. Origlia, [arXiv:2201.11777](#) [quant-ph].
6. *Monstrous M-theory*, A. Marrani, M. Rios, D. Chester, [arXiv:2008.06742](#) [hep-th].
7. *Black Holes and Higher Composition Laws*, L. Borsten, M.J. Duff, A. Marrani, [arXiv:2006.03574](#) [hep-th].
8. *Beyond the standard model with six-dimensional spacetime*, D. Chester, M. Rios, A. Marrani, [arXiv:2002.02391](#) [physics.gen-ph].
9. *Exceptional Periodicity and Magic Star Algebras. II : Gradings and HT-Algebras*, P. Truini, A. Marrani, M. Rios, [arXiv:1910.07914](#) [math.RT].
10. *Exceptional Periodicity and Magic Star Algebras. I : Foundations*, P. Truini, A. Marrani, M. Rios, [arXiv:1909.00357](#) [math.RT].
11. *Freudenthal duality and conformal isometries of extremal black holes*, L. Borsten, M.J. Duff, A. Marrani, [arXiv:1812.10076](#) [gr-qc].
12. *Non-Planar Spin Bits beyond two loops*, S. Bellucci, A. Marrani, [hep-th/0505106](#).

Research Papers (Published)

1. *Black hole attractors and $U(1)$ Fayet-Iliopoulos gaugings: analysis and classification*, D. Aste-siano, S. L. Cacciatori, A. Marrani, JHEP **04** (2022) 99, [arXiv:2112.04962](#) [hep-th], DOI: 10.1007/JHEP04(2022)099.

2. *Classification of four qubit states and their stabilisers under SLOCC operations*, H. Dietrich, W. A. de Graaf, A. Marrani, M. Origlia, J.Phys. **A55** 095302 (2022), [arXiv:2111.05488 \[quant-ph\]](#), <https://doi.org/10.1088/1751-8121/ac4b13>.
3. *BPS Black Hole Entropy and Attractors in Very Special Geometry. Cubic Forms, Gradient Maps and their Inversion*, B. van Geemen, A. Marrani, F. Russo, JHEP **12** (2021) 195, [arXiv:2009.10647 \[hep-th\]](#), DOI: 10.1007/JHEP12(2021)195.
4. *Space, Matter and Interactions in a Quantum Early Universe. Part II : Superalgebras and Vertex Algebras*, P. Truini, A. Marrani, M. Rios, K. Irwin, Symmetry **2021**, 13, 2289, [arXiv:2012.10248 \[gr-qc\]](#), <https://doi.org/10.3390/sym13122289>.
5. *Space, Matter and Interactions in a Quantum Early Universe. Part I : Kac-Moody and Borcherds Algebras*, P. Truini, A. Marrani, M. Rios, K. Irwin, Symmetry **2021**, 13, 2342, [arXiv:2012.10227 \[gr-qc\]](#), <https://doi.org/10.3390/sym13122342>.
6. *Warm Dark Matter from Higher-Dimensional Gauge Theories*, S. Paduroiu, M. Rios, A. Marrani, D. Chester, Universe **2021**, 7(12), 462, [arXiv:2202.08459 \[astro-ph.CO\]](#), <https://doi.org/10.3390/universe7120462>.
7. *Special Vinberg Cones and the Entropy of BPS Extremal Black Holes*, D. V. Alekseevsky, A. Marrani, A. Spiro, JHEP **11** (2021) 100, [arXiv:2107.06797 \[hep-th\]](#), DOI: 10.1007/JHEP11(2021)100.
8. *On Generalized Lemaitre-Tolman-Bondi Metric. Fractal Matter at the end of Matter-Antimatter Recombination*, S. L. Cacciatori, A. Marrani, F. Re, Int. J. Mod. Phys. **D30**, no. 11, 2150086 (2021), [arXiv:2011.11086 \[gr-qc\]](#), DOI: 10.1142/S0218271821500863.
9. *Exceptional Super Yang-Mills in $D = 27 + 3$ and Worldvolume M-Theory*, M. Rios, A. Marrani, D. Chester, Phys. Lett. **B808**, 135674 (2020), [arXiv:1906.10709 \[hep-th\]](#), DOI: 10.1016/j.physletb.2020.135674.
10. *Real forms of embeddings of maximal reductive subalgebras of the complex simple Lie algebras of rank up to 8*, W. A. de Graaf, A. Marrani, J. Phys. A: Math. Theor. **53** 155203 (2020), [arXiv:1911.06575 \[math.RA\]](#), DOI: 10.1088/1751-8121/ab7c8c.
11. *Jordan Algebraic Interpretation of Maximal Parabolic Subalgebras : Exceptional Lie Algebras*, V. Dobrev, A. Marrani, J. Phys. **A53** (2020) no.5, 055203, [arXiv:1905.00289 \[math.RT\]](#), DOI: 10.1088/1751-8121/ab5f84.
12. *Orbits in Non-Supersymmetric Magic Theories*, A. Marrani, L. Romano, Int. J. Mod. Phys. **A34**, no. 32, 1950190 (2019), [arXiv:1906.05830 \[hep-th\]](#), DOI: 10.1142/S0217751X19501902.
13. *Lagrangian Grassmannians and spinor varieties in characteristic two*, B. Van Geemen, A. Marrani, SIGMA **15** (2019) 064, [arXiv:1903.01228 \[math-ph\]](#), DOI: 10.3842/SIGMA.2019.064.
14. *Black holes and general Freudenthal transformations*, L. Borsten, M.J. Duff, J.J. Fernandez-Melgarejo, A. Marrani, E. Torrente-Lujan, JHEP **1907** (2019) 070, [arXiv:1905.00038 \[hep-th\]](#), DOI: 10.1007/JHEP07(2019)070.
15. *Twin conformal field theories*, L. Borsten, M.J. Duff, A. Marrani, JHEP **1903** (2019) 112, [arXiv:1812.11130 \[hep-th\]](#), DOI: 10.1007/JHEP03(2019)112.
16. *The Geometry of Exceptional Super Yang-Mills Theories*, M. Rios, A. Marrani, D. Chester, Phys. Rev. **D99** (2019) 046004, [arXiv:1811.06101 \[hep-th\]](#) DOI : 10.1103/PhysRevD.99.046004.
17. *The q -linked complex Minkowski space, its real forms and deformed isometry groups*, R. Fiorese, E. Latini, A. Marrani, Int. J. Geom. Meth. Mod. Phys. **16** (2018) no.01, 1950009, [arXiv:1803.04730 \[hep-th\]](#), DOI: 10.1142/S0219887819500099.

18. *Are all Supergravity Theories Yang-Mills Squared?*, A. Anastasiou, L. Borsten, M.J. Duff, A. Marrani, S. Nagy, M. Zoccali, Nucl. Phys. **B934** (2018) 606, [arXiv:1707.03234 \[hep-th\]](#), <https://doi.org/10.1016/j.nuclphysb.2018.07.023>.
19. *Extremal Black Holes, Stueckelberg Scalars and Phase Transitions*, A. Marrani, O. Miskovic, P. Quezada Leon, JHEP **02** (2018) 080, [arXiv:1712.01425 \[hep-th\]](#), [https://doi.org/10.1007/JHEP02\(2018\)080](https://doi.org/10.1007/JHEP02(2018)080).
20. *A Kind of Magic*, L. Borsten, A. Marrani, Class. Quant. Grav. **34** 235014 (2017), [arXiv:1707.02072 \[hep-th\]](#), DOI: 10.1088/1361-6382/aa8fe2.
21. *Quantum Klein Space and Superspace*, R. Fiorese, E. Latini, A. Marrani, SIGMA **14** (2018) 066, [arXiv:1705.01755 \[hep-th\]](#), DOI: 10.3842/SIGMA.2018.066.
22. *Supersymmetric Black Holes and Freudenthal Duality*, T. Mandal, A. Marrani, P. K. Tripathy, Int. J. Mod. Phys. **A32** (2017) 1750114, [arXiv:1703.08669 \[hep-th\]](#), DOI: 10.1142/S0217751X17501147.
23. *Nonlinear symmetries of black hole entropy in gauged supergravity*, D. Klemm, A. Marrani, N. Petri, M. Rabbiosi, JHEP **1704** (2017) 013, [arXiv:1701.08536 \[hep-th\]](#), DOI: 10.1007/JHEP04(2017)013.
24. *Non-Supersymmetric Magic Theories and Ehlers Truncations*, A. Marrani, G. Pradisi, F. Riccioni, L. Romano, Int. J. Mod. Phys. **A32** (2017) 1750120, [arXiv:1701.03031 \[hep-th\]](#), DOI: 10.1142/S0217751X17501202.
25. *Peccei-Quinn Transformations and Black Holes : Orbit Transmutations and Entanglement Generation*, T. Prudencio, A. Marrani, D. J. Cirilo-Lombardo, Universe **3** (2017) 12, [arXiv:1612.00344 \[hep-th\]](#), DOI:10.3390/universe3010012.
26. *$D = 3$ Unification of Curious Supergravities*, M. J. Duff, S. Ferrara, A. Marrani, JHEP **1701** (2017) 023, [arXiv:1610.08800 \[hep-th\]](#), DOI: 10.1007/JHEP01(2017)023.
27. *Twin Supergravities from Yang-Mills Squared*, A. Anastasiou, L. Borsten, M. J. Duff, M. J. Hughes, A. Marrani, S. Nagy, M. Zoccali, Phys.Rev. **D96** (2017) no.2, 026013, [arXiv:1610.07192 \[hep-th\]](#), DOI : 10.1103/PhysRevD.96.026013.
28. *One-Dimensional Super Calabi-Yau Manifolds and their Mirrors*, S. Noja, S. L. Cacciatori, F. Dalla Piazza, A. Marrani, R. Re, JHEP **1704** (2017) 094, [arXiv:1609.03801 \[hep-th\]](#), DOI:10.1007/JHEP04(2017)094.
29. *Klein and Conformal Superspaces, Split Algebras and Spinor Orbits*, R. Fiorese, E. Latini, A. Marrani, Rev. Math. Phys. **29**, 1750011 (2017), [arXiv:1603.09063 \[hep-th\]](#), DOI: <http://dx.doi.org/10.1142/S0129055X17500118>.
30. *BPS Black Holes in a Non-Homogeneous Deformation of the stu model of $\mathcal{N} = 2$, $D = 4$ Gauged Supergravity*, D. Klemm, A. Marrani, N. Petri, C. Santoli, JHEP **1509** (2015) 205, [arXiv:1507.05553 \[hep-th\]](#), DOI: 10.1007/JHEP09(2015)205.
31. *Sextonions, Zorn Matrices, and $e_{71/2}$* , A. Marrani, P. Truini, Lett. Math. Phys. **107** (2017) 1859, [arXiv:1506.04604 \[math.RA\]](#), DOI: 10.1007/s11005-017-0966-7.
32. *Real weights, bound states and duality orbits*, A. Marrani, F. Riccioni, L. Romano, Int. J. Mod. Phys. **A31**, 1550218 (2016), [arXiv:1501.06895 \[hep-th\]](#), DOI: 10.1142/S0217751X15502188.
33. *Symplectic Deformations of Gauged Maximal Supergravity*, G. Dall'Agata, G. Inverso, A. Marrani, JHEP **1407** (2014) 133, [arXiv:1405.2437 \[hep-th\]](#), DOI: 10.1007/JHEP07(2014)133.
34. *Exceptional Lie Algebras, $SU(3)$ and Jordan Pairs Part 2: Zorn-type Representations*, A. Marrani, P. Truini, J.Phys. **A47** (2014) 265202, [arXiv:1403.5120 \[math-ph\]](#), DOI: 10.1088/1751-8113/47/26/265202.
35. *No Fermionic Wigs for BPS Attractors in 5 Dimensions*, G. L. C. Gentile, P. A. Grassi, A. Marrani, A. Mezzalana, W. A. Sabra, Phys. Lett. **B735** (2014) 231, [arXiv:1403.5097 \[hep-th\]](#), DOI: 10.1016/j.physletb.2014.06.026.

36. *Iwasawa nilpotency degree of non compact symmetric cosets in $\mathcal{N}$ -extended Supergravity*, S. L. Cacciatori, B. L. Cerchiai, S. Ferrara, A. Marrani, Fortsch.Phys. **62** (2014) 350, [arXiv:1402.5063 \[hep-th\]](#), DOI: 10.1002/prop.201400010.
37. *Fermions, Wigs, and Attractors*, G. L. C. Gentile, P. A. Grassi, A. Marrani, A. Mezzalana, Phys. Lett. **B732**, 263 (2014), [arXiv:1309.0821 \[hep-th\]](#), DOI: 10.1016/j.physletb.2014.03.046.
38. *Dualities Near the Horizon*, S. Ferrara, A. Marrani, E. Orazi, M. Trigiante, JHEP **1311**, 056 (2013), [arXiv:1305.2057 \[hep-th\]](#), DOI: 10.1007/JHEP11(2013)056.
39. *Freudenthal Dual Lagrangians*, L. Borsten, M. J. Duff, S. Ferrara, A. Marrani, Class. Quant. Grav **30**, 235003 (2013), [arXiv:1212.3254 \[hep-th\]](#), DOI: 10.1088/0264-9381/30/23/235003.
40. *Multi-Centered Invariants, Plethysm and Grassmannians*, S. L. Cacciatori, A. Marrani, B. van Geemen, JHEP **1302**, 049 (2013), [arXiv:1211.3432 \[math-ph\]](#), DOI: 10.1007/JHEP02(2013)049.
41. *Multi-Centered First Order Formalism*, S. Ferrara, A. Marrani, A. Shcherbakov, A. Yeranyan, JHEP **1305**, 127 (2013), [arXiv:1211.3262 \[hep-th\]](#), DOI: 10.1007/JHEP05(2013)127.
42. *d-Geometries Revisited*, A. Ceresole, S. Ferrara, A. Gnechchi, A. Marrani, JHEP **1302**, 059 (2013), [arXiv:1210.5983 \[hep-th\]](#), DOI: 10.1007/JHEP02(2013)059.
43. *Squaring the Magic*, S. L. Cacciatori, B. L. Cerchiai, A. Marrani, Adv. Theor. Math. Phys. vol. **19**, no. 5, 923 (2015), [arXiv:1208.6153 \[math-ph\]](#), DOI: <http://dx.doi.org/10.4310/ATMP.2015.v19.n5.a1>.
44. *Jordan Pairs, E_6 and U-Duality in Five Dimensions*, S. Ferrara, A. Marrani, B. Zumino, J. Phys. **A42**, 065402 (2013), [arXiv:1208.0347 \[math-ph\]](#), DOI: 10.1088/1751-8113/46/6/065402.
45. *Freudenthal Gauge Theory*, A. Marrani, C.-X. Qiu, S.-Y. D. Shih, A. Tagliaferro, B. Zumino, JHEP **1303**, 132 (2013), [arXiv:1208.0013 \[hep-th\]](#), DOI: 10.1007/JHEP03(2013)132.
46. *Super-Ehlers in Any Dimension*, S. Ferrara, A. Marrani, M. Trigiante, JHEP **1211** (2012) 068, [arXiv:1206.1255 \[hep-th\]](#), DOI: 10.1007/JHEP11(2012)068.
47. *Degeneration of Groups of Type E_7 and Minimal Coupling in Supergravity*, S. Ferrara, R. Kallosh, A. Marrani, JHEP **1206**, 074 (2012), [arXiv:1202.1290 \[hep-th\]](#), DOI: 10.1007/JHEP06(2012)074.
48. *Magic Coset Decompositions*, S. L. Cacciatori, B. L. Cerchiai, A. Marrani, Adv. Theor. Math. Phys. vol. **17**, no. 5, 1077 (2013), [arXiv:1201.6314 \[hep-th\]](#), DOI: <http://dx.doi.org/10.4310/ATMP.2013.v17.n5.a4>.
49. *Brane Orbits*, E. A. Bergshoeff, A. Marrani, F. Riccioni, Nucl. Phys. **B861**, 104 (2012), [arXiv:1201.5819 \[hep-th\]](#), DOI: 10.1016/j.nuclphysb.2012.03.014.
50. *On Invariant Structures of Black Hole Charges*, S. Ferrara, A. Marrani, A. Yeranyan, JHEP **1202**, 071 (2012), [arXiv:1110.4004 \[hep-th\]](#), DOI: 10.1007/JHEP02(2012)071.
51. *Generalized Mirror Symmetry and Quantum Black Hole Entropy*, S. Ferrara, A. Marrani, Phys. Lett. **B707**, 173 (2012), [arXiv:1109.0444 \[hep-th\]](#), DOI: 10.1016/j.physletb.2011.12.005.
52. *Explicit Orbit Classification of Reducible Jordan Algebras and Freudenthal Triple Systems*, L. Borsten, M. J. Duff, S. Ferrara, A. Marrani, W. Rubens, Commun. Math. Phys. **325**, 17 (2014), [arXiv:1108.0908 \[math.RA\]](#), DOI: 10.1007/s00220-013-1846-3.
53. *Small Orbits*, L. Borsten, M. J. Duff, S. Ferrara, A. Marrani, W. Rubens, Phys. Rev. **D85**, 086002 (2012), [arXiv:1108.0424 \[hep-th\]](#), DOI: 10.1103/PhysRevD.85.086002.

54. *Small Black Hole Constituents and Horizontal Symmetry*, A. Ceresole, S. Ferrara, A. Marrani, A. Yeranyan, JHEP **1106**, 078 (2011), [arXiv:1104.4652 \[hep-th\]](#), DOI: 10.1007/JHEP06(2011)078.
55. *Freudenthal Duality and Generalized Special Geometry*, S. Ferrara, A. Marrani, A. Yeranyan, Phys. Lett. **B701**, 640 (2011), [arXiv:1102.4857 \[hep-th\]](#), DOI: 10.1016/j.physletb.2011.06.031.
56. *On the Black-Hole/Qubit Correspondence*, L. Borsten, M. J. Duff, A. Marrani, W. Rubens, Eur. Phys. J. Plus **126**, 37 (2011), [arXiv:1101.3559 \[hep-th\]](#), DOI: 10.1140/epjp/i2011-11037-5.
57. *Two-Centered Magical Charge Orbits*, L. Andrianopoli, R. D'Auria, S. Ferrara, A. Marrani, M. Trigiante, JHEP **1104**, 041 (2011), [arXiv:1101.3496 \[hep-th\]](#), DOI: 10.1007/JHEP04(2011)041.
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60. *Topics in Cubic Special Geometry*, S. Bellucci, A. Marrani, R. Roychowdhury, J. Math. Phys. **52**, 082302 (2011), [arXiv:1011.0705 \[hep-th\]](#), DOI: 10.1063/1.3622851.
61. *Split Attractor Flow in $\mathcal{N} = 2$ Minimally Coupled Supergravity*, S. Ferrara, A. Marrani, E. Orazi, Nucl. Phys. **B846**, 512 (2011), [arXiv:1010.2280 \[hep-th\]](#), DOI: 10.1016/j.nuclphysb.2011.01.015.
62. *Matrix Norms, BPS Bounds and Marginal Stability in $\mathcal{N} = 8$ Supergravity*, S. Ferrara, A. Marrani, JHEP **1012**, 038 (2010), [arXiv:1009.3251 \[hep-th\]](#), DOI: 10.1007/JHEP12(2010)038.
63. *Superconformal Symmetry, NMSSM, and Inflation*, S. Ferrara, R. Kallosh, A. Linde, A. Marrani, A. Van Proeyen, Phys. Rev. **D83**, 025008 (2011), [arXiv:1008.2942 \[hep-th\]](#), DOI: 10.1103/PhysRevD.83.025008.
64. *Charge Orbits of Extremal Black Holes in Five Dimensional Supergravity*, B. L. Cerchiai, S. Ferrara, A. Marrani, B. Zumino, Phys. Rev. **D82**, 085010 (2010), [arXiv:1006.3101 \[hep-th\]](#), DOI: 10.1103/PhysRevD.82.085010.
65. *Small $\mathcal{N} = 2$ Extremal Black Holes in Special Geometry*, A. Ceresole, S. Ferrara, A. Marrani, Phys. Lett. **B693**, 366 (2010), [arXiv:1006.2007 \[hep-th\]](#), DOI: 10.1016/j.physletb.2010.08.053.
66. *Geodesics of deformed relativity in five dimensions*, F. Cardone, A. Marrani and R. Mignani, Electron. J. Theor. Phys. **7** 23, 281 (2010).
67. *Four-qubit entanglement classification from string theory*, L. Borsten, D. Dahanayake, M. J. Duff, A. Marrani, W. Rubens, Phys. Rev. Lett. **105**, 100507 (2010), [arXiv:1005.4915 \[hep-th\]](#), DOI: 10.1103/PhysRevLett.105.100507.
68. *Iwasawa $\mathcal{N} = 8$ Attractors*, S. L. Cacciatori, B. L. Cerchiai, A. Marrani, J. Math. Phys. **51**, 102502 (2010), [arXiv:1005.2231 \[hep-th\]](#), DOI: 10.1063/1.3501024.
69. *Jordan Frame Supergravity and Inflation in NMSSM*, S. Ferrara, R. Kallosh, A. Linde, A. Marrani, A. Van Proeyen, Phys. Rev. **D82**, 045003 (2010), [arXiv:1004.0712 \[hep-th\]](#), DOI: 10.1103/PhysRevD.82.045003.
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75. *Killing symmetries of deformed relativity in five dimensions*, F. Cardone, A. Marrani and R. Mignani, *Electron. J. Theor. Phys.* **6** 20, 59 (2009).
76. *Duality, Entropy and ADM Mass in Supergravity*, B. L. Cerchiai, S. Ferrara, A. Marrani, B. Zumino, *Phys. Rev.* **D79**, 125010 (2009), [arXiv:0902.3973](#), DOI: 10.1103/PhysRevD.79.125010.
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Contributions to Proceedings (Preprints):

1. *Attractor Horizon Geometries of Extremal Black Holes*, S. Bellucci, S. Ferrara and A. Marrani, [hep-th/0702019](#),
17th SIGRAV Conference,
Turin, Italy, 4-7 Sep 2006.

Contributions to Proceedings (Published):

1. *Non-Linear Symmetries in Maxwell-Einstein Gravity: from Freudenthal Duality to Pre-Homogeneous Vector Spaces*, A. Marrani,
Lie Theory and Its Applications in Physics, Varna, Bulgaria, June 17-23, 2020, Springer Proc. in Math. and Stat. **335**, Springer Singapore (2020), DOI: 10.1007/978-981-15-7775-8.
2. *The Magic of Being Exceptional*, A. Marrani, P. Truini, M. Rios,
32nd International Colloquium on Group Theoretical Methods in Physics, Technical University of Prague, Prague, Czech Republic, July 9-13, 2018, J. Phys. Conf. Ser. **1194** (2019) no.1, 012075, [arXiv:1811.11208 \[hep-th\]](#), DOI: 10.1088/1742-6596/1194/1/012075.

3. *Magic Star and Exceptional Periodicity: an approach to Quantum Gravity*, P. Truini, A. Marrani, M. Rios,
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in : *Nonassociative Mathematics and its Applications*", Contemporary Mathematics, Volume 721, (2019), 1-28, [arXiv:1711.08476 \[hep-th\]](#), <https://doi.org/10.1090/conm/721>.
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in : *Nonassociative Mathematics and its Applications*", Contemporary Mathematics, Volume 721, (2019), 277-297, [arXiv:1711.07881 \[hep-th\]](#), <https://doi.org/10.1090/conm/721>.
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and Celebration of the Triumph of Ettore Majorana,
Erice, 24 June-3 July 2015,
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8. *Freudenthal Duality in Gravity: from Groups of Type E_7 to Pre-Homogeneous Spaces* , A. Marrani, [arXiv:1509.01031 \[hep-th\]](#),
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9. *Exceptional Lie Algebras at the very Foundations of Space and Time*, A. Marrani, P. Truini, [arXiv:1506.08576 \[hep-th\]](#),
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10. *Electric - Magnetic Duality and Supersymmetry*, P. Aschieri, S. Ferrara, A. Marrani, Subnucl. Ser. **51**, 91 (2015),
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Erice, Italy, June 24 July 3, 2013.
11. *Adams-Iwasawa $\mathcal{N} = 8$ Black Holes*, S. L. Cacciatori, B. L. Cerchiai, A. Marrani, Int. J. Mod. Phys. Conf. Ser. **13**, 44 (2012), [arXiv:1202.3055 \[hep-th\]](#),
DOI: 10.1142/S2010194512006721.
12. *On Symmetries of Extremal Black Holes with One and Two Centers*, S. Ferrara, A. Marrani, Springer Proc.Phys. **144**, 345 (2013), [arXiv:1207.7016 \[hep-th\]](#), DOI: 10.1007/978-3-319-00215-6_9,
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13. *On the Scalar Manifold of Exceptional Supergravity*, S. L. Cacciatori, B. L. Cerchiai, A. Marrani, Fortsch.Phys. **60** (2012) 952, [arXiv:1201.6667 \[hep-th\]](#), DOI: 10.1002/prop.201200026, XVII European Workshop on String Theory, Padua, Italy, September 5-9, 2011.
14. *Quantum Gravity needs Supersymmetry*, S. Ferrara, A. Marrani, [arXiv:1201.4328 \[hep-th\]](#), Subnucl.Ser. **49** (2013) 53-67, DOI: 10.1142/9789814522519_0003, International School of Subnuclear Physics, 49th Course: *Searching for the Unexpected at LHC and Status of Our Knowledge*, Erice, Italy, June 24 – July 3, 2011.
15. *Black Holes and Groups of Type E_7* , S. Ferrara, A. Marrani, Pramana **78**, 893 (2012), [arXiv:1112.2664 \[hep-th\]](#), DOI: 10.1007/s12043-012-0315-4, Conference in Honor of Raymond Storas 80th Birthday, LAPTh, Annecy, July 8, 2011.
16. *Perturbative and Non-Perturbative Aspects of $\mathcal{N} = 8$ Supergravity*, S. Ferrara, A. Marrani, Subnucl.Ser. **48**, 67 (2013), [arXiv:1103.5138 \[hep-th\]](#), International School of Subnuclear Physics, 48th Course: *What is Known and Unexpected at LHC*, Erice, Italy, 29 August – 7 September 2010, DOI: 10.1142/9789814522489_0004.
17. *Charge Orbits and Moduli Spaces of Black Hole Attractors*, A. Marrani, Lect. Notes Math. **2027**, 155 (2011), [arXiv:1012.3559 \[hep-th\]](#), DOI: 10.1007/978-3-642-21744-9_8, Workshop *Supersymmetry in Mathematics and Physics*, UCLA Mathematics Department, Los Angeles, CA, USA, February 67 2010.
18. *SAM Lectures on Extremal Black Holes in $d=4$ Extended Supergravity*, S. Bellucci, S. Ferrara, M. Günaydin, A. Marrani, Springer Proc. in Physics **134**, 1 (2010), [arXiv:0905.3739](#), DOI: 10.1007/978-3-642-10736-8_1, "School on Attractor Mechanism" 2007 (SAM2007), INFN-LNF, Frascati, Italy, June 18-22, 2007.
19. *Status of Supersymmetry : Foundations and Applications*, S. Ferrara, A. Marrani, in: "Predicted and Totally Unexpected in the Energy Frontier Opened by LHC", A. Zichichi (Ed.), Subnucl. Ser. **46** (2011) 277, World Scientific (Singapore, 2011), DOI: 10.1142/9789814340212_0010.
20. *Symmetric Spaces in Supergravity*, S. Ferrara and A. Marrani, in: "Symmetry in Mathematics and Physics" (D. Babbitt, V. Vyjayanthi and R. Fiorese Eds.), Contemporary Mathematics **490**, American Mathematical Society, Providence 2009, [arXiv:0808.3567](#).
21. *Lectures on Attractors and Black Holes*, S. Ferrara, K. Hayakawa and A. Marrani, Fortsch. Phys. **56**, 993 (2008), [arXiv:0805.2498](#), DOI: 10.1002/prop.200810569, International School of Subnuclear Physics, 45th Course: "Search for the Totally Unexpected in the LHC era", Erice, Italy, 29 August – 7 September 2007.
22. *Attractors in Black*, S. Bellucci, S. Ferrara and A. Marrani, Fortsch. Phys. **56**, 761 (2008), [arXiv:0805.1310](#), DOI: 10.1002/prop.200810566, 3rd RTN Workshop *Constituents, Fundamental Forces and Symmetries of the Universe*, 15 October 2007, Valencia, Spain.
23. *Extremal Black Hole and Flux Vacua Attractors*, S. Bellucci, S. Ferrara, R. Kallosh and A. Marrani, Lect. Notes Phys. **755**, 115 (2008), [arXiv:0711.4547](#), "Winter School on Attractor Mechanism" 2006 (SAM2006), INFN-LNF, Frascati, Italy, 20-24 March 2006.
24. *Black Hole Attractors in Extended Supergravity*, S. Ferrara and A. Marrani, AIP Conf. Proc. **957**, 58 (2007), [arXiv:0708.1268](#), DOI: 10.1063/1.2823828, PASCOS 2007, 13th International Symposium on Particles, Strings and Cosmology, Imperial College, London, UK, 27 July 2007.

25. *Spin-Bits and $\mathcal{N} = 4$ SYM*, A. Marrani, in: “*Towards New Milestones in Our Quest To Go Beyond the Standard Model*”, A. Zichichi (Ed.), Subnucl.Ser. **43**, 345 (2007), World Scientific (Singapore), hep-th/0604174, DOI: 10.1142/9789812779120_0015.

Books :

1. *Supersymmetric Mechanics*.
Vol.2: *The Attractor Mechanism and Space-Time Singularities*,
S. Bellucci, S. Ferrara and A. Marrani,
Lecture Notes in Physics vol. **701**, Springer-Verlag, Heidelberg (2006), DOI: 10.1007/b11749356.

Thesis Supervision :

1. Ph.D. student: R. Roychowdhury, University of Naples, Italy.
Thesis Title: “*Selected Topics in Quantum Gravity : a Maiden Voyage*”
Date: Jan. 2011. Mark: *Ottimo*.
2. Master student: F. Muscolino, University of Milano, Italy.
Thesis Title: “*Supersymmetry Breaking in Supergravity via the Double Copy Approach*”
Date: Apr. 2018.

PhD Committee member :

1. Ph.D. student: C. S. Shabhazi, IFT, UAM - CSIC, Madrid, Spain.
Thesis Title: “*Black Holes in Supergravity with Applications to String Theory*”
Date: June 2013. Mark: *Excellent*.

Schools, Conferences and Workshops :

- | | |
|------------------------------|--|
| 2022, July, 18-22 | : <i>Plenary Speaker</i>
<i>GROUP34 : the 34th International Colloquium on Group Theoretical Methods in Physics</i> ,
Strasbourg, France. |
| 2021, June, 20-26 | : <i>Invited Speaker</i>
<i>Lie Theory and its Applications in Physics (LT14)</i> ,
BAS, Sofia, Bulgaria [changed to online version]. |
| 2019, June, 17-23 | : <i>Invited Speaker</i>
<i>Lie Theory and its Applications in Physics (LT13)</i> ,
BAS, Varna, Bulgaria. |
| 2019, February, 14-15 | : <i>Member of the Organizing Committee</i>
<i>Workshop on Geometric Structures in Mathematics and Physics</i> ,
Univ. of Bologna, Mathematics Dept., Bologna, Italy. |
| 2018, October, 12 | : <i>Member of the Organizing Committee</i>
<i>A Quantum Day in Bologna</i> ,
Univ. of Bologna, Mathematics Dept., Bologna, Italy. |
| 2018, July, 9-13 | : <i>Group32 : 32nd International Colloquium on Group Theoretical Methods in Physics</i> ,
Technical University of Prague, Dept. of Mathematics, Prague, Czech Republic. |

- 2018, June, 27 - 29 : ***Invited Speaker***
Advances in Quantum Gravity IV (AQG IV) 2018,
UCLA, Dept. of Astronomy and Physics, Los Angeles, CA, USA.
- 2018, June, 14 - 23 : *International School of Subnuclear Physics, 56th Course:*
From Gravitational Waves to QED, QFD and QCD,
“Ettore Majorana” Foundation and Centre for Scientific Culture (EM-FCSC),
Erice, Italy.
- 2018, May, 23-26 : ***Invited Speaker***
Gravity, Duality and Strings,
University of Murcia, Dept. of Physics, Murcia, Spain.
- 2018, April, 9 - 13 : *Strings, Higher Spins and Dualities in Pucon*,
Pucon, Chile.
- 2018, March, 4 - 10 : *Geometry, Analysis, Physics*,
Winter School, Geilo, Norway.
- 2018, January, 19 : ***Invited Speaker***
Gravity Winter Workshop 2018,
University of Murcia, Dept. of Physics, Murcia, Spain.
- 2017, October, 13 : ***Member of the Organizing Committee***
A Lie Day in Bologna,
Univ. of Bologna, Mathematics Dept., Bologna, Italy.
- 2017, September, 11 - 15 : *103rd National Congress of SIF (Italian Physics Society)*,
University of Trento, Trento, Italy.
- 2017, July, 5 - 12 : *EPS Conference on High Energy Physics*,
Venice, Italy.
- 2017, June, 14 - 23 : *International School of Subnuclear Physics, 55th Course:*
Highlights from LHC and the other Frontiers in Physics,
“Ettore Majorana” Foundation and Centre for Scientific Culture (EM-FCSC),
Erice, Italy.
- 2017, May, 22 - 26 : ***Invited Speaker***
Symposium on Quantum Gravity,
Quantum Gravity Research headquarters, Los Angeles, CA USA.
- 2017, May 18 - 19 : *Supergravity 2017*
University of Padova, Physics and Astronomy Dept., Padova, Italy.
- 2017, April, 24 - 28 : ***Invited Speaker***
Geometry, Gravity and Supersymmetry,
Mainz Institute for Theoretical Physics, Johannes Gutenberg University, Mainz, Germany.
- 2016, December, 10 - 18 : ***Invited Speaker***
Advances in Quantum Gravity III (AQG III) 2016,
Pacific Science Institute (PSI), Maui, HI, USA.
- 2016, December, 5 - 9 : *QCD Meets Gravity*,
Bhaumik Institute for Theoretical Physics, UCLA, USA.
- 2016, September, 26 - 30 : *102nd National Congress of SIF (Italian Physics Society)*,
University of Padova, Padova, Italy.

- 2016, July, 8 - 16** : *Invited Speaker*
Advances in Quantum Gravity (AQG) 2016,
 Topos House, San Francisco, CA, USA.
- 2016, June, 29 - 30** : *Invited Scientist*
Two Days in Quantum Mechanics,
 University of Genova, Physics Dept., Genova, Italy.
- 2016, June, 14 - 23** : *International School of Subnuclear Physics, 54th Course:*
The New Physics Frontiers in the LHC-2 Era,
 “Ettore Majorana” Foundation and Centre for Scientific Culture (EM-FCSC),
 Erice, Italy.
- 2016, May, 1 - 7** : *Invited Speaker*
Superstring Solutions, Supersymmetry and Geometry 2016,
 Centro de Ciencias de Benasque “Pedro Pascual”, Benasque, Spain.
- 2016, January, 20 - 22** : *Invited Scientist*
Workshop of Algebraic Geometry and Physics 2016,
 Villa del Grumello, Como, Italy.
- 2015, November, 23 - 24** : *Invited Speaker*
Advances in Quantum Gravity (AQG) 2015,
 Los Angeles, CA, USA.
- 2015, October, 1** : *Invited Speaker*
A Lie Day in Bologna,
 Univ. of Bologna, Mathematics Dept., Bologna, Italy.
- 2015, July, 12 - 18** : *14th Marcel Grossmann Meeting*
 University of Roma “La Sapienza”, Physics Dept., Roma, Italy.
- 2015, June, 24 - July, 3** : *International School of Subnuclear Physics, 53rd Course:*
The Future of Our Physics, Including New Frontier,
 “Ettore Majorana” Foundation and Centre for Scientific Culture (EM-FCSC),
 Erice, Italy.
- 2015, April, 27 - 28** : *Invited Speaker*
Bruno Zumino Memorial Meeting 2015,
 Main Auditorium, CERN, Geneva, Switzerland.
- 2014, November 7 - 9** : *Invited Speaker,*
Group Theory, Probability, and the Structure of Spacetime
A Conference on the occasion of Professor Varadarajan’s retirement,
 Department of Mathematics, University of California, Los Angeles, USA.
- 2014, September, 8 - 12** : *International Conference*
Conceptual and Technical Challenges for Quantum Gravity 2014,
 Univ. of Roma “La Sapienza”, Physics Dept., Roma, Italy.
- 2014, June, 24 - July, 3** : *International School of Subnuclear Physics, 52nd Course:*
Status of Theoretical Understanding and of Experimental Power for LHC Physics and Beyond,
 “Ettore Majorana” Foundation and Centre for Scientific Culture (EM-FCSC),
 Erice, Italy.

- 2013, June, 24 - July, 3** : ***Julian Schwinger Diploma,***
International School of Subnuclear Physics, 51st Course:
Reflections on the Next Step for LHC,
 “Ettore Majorana” Foundation and Centre for Scientific Culture (EM-FCSC),
 Erice, Italy.
- 2012, June 23 - July 2** : *International School of Subnuclear Physics, 50th Course:*
What We Would Like LHC To Give Us,
 “Ettore Majorana” Foundation and Center for Scientific Culture (EM-FCSC), Erice, Italy.
- 2011, November, 15 - 17** : *The supersymmetric, the extremal*
and the ugly - solutions in string theory,
 IPHT CEA Saclay, Paris, France.
- 2011, June 24 - July 3** : ***Invited Scientist,***
International School of Subnuclear Physics, 49th Course:
Searching for the Unexpected at LHC
and Status of our Knowledge,
 “Ettore Majorana” Foundation and Center for Scientific Culture (EM-FCSC), Erice, Italy.
- 2011, May, 9-13** : ***Invited Speaker,***
Black Objects in Supergravity School (BOSS 2011),
 INFN - Frascati National Laboratories (LNF), Rome, Italy.
- 2011, January, 24 - 28** : *CERN Winter School on Supergravity, Strings*
and Gauge Theory,
 CERN, Switzerland.
- 2010, August, 29 - Sept., 7** : *International School of Subnuclear Physics, 48th Course:*
What is known and unexpected at LHC ,
 “Ettore Majorana” Foundation and Center for Scientific Culture (EM-FCSC), Erice, Italy.
- 2010, February, 6 - 7** : *Supersymmetry in Mathematics and Physics,*
 Mathematics Dept., UCLA, USA.
- 2009, August, 29 - Sept., 7** : *International School of Subnuclear Physics, 47th Course:*
The Most Unexpected at LHC and the Status of High Energy Frontier,
 “Ettore Majorana” Foundation and Center for Scientific Culture (EM-FCSC), Erice, Italy.
- 2009, June, 29 - July, 3** : *School on attractor Mechanism (SAM) 2009,*
 INFN - Frascati National Laboratories, Rome, Italy.
- 2009, June, 22-26** : *Strings 2009,*
 Rome, Italy.
- 2009, June, 15-19** : *“New Perspectives in String Theory” School,*
 GGI Institute, Florence, Italy.
- 2008, August, 29 - Sept., 7** : *International School of Subnuclear Physics, 46th Course: Homage to*
Sidney Coleman :
Predicted and Totally Unexpected in the Energy Frontier opened by
LHC,
 “Ettore Majorana” Foundation and Center for Scientific Culture (EM-FCSC), Erice, Italy.
- 2008, August, 18-23** : *Strings 2008,*
 CERN, Switzerland.

- 2008, June, 26-28 : *Theories of Fundamental Interactions*,
Villa Mondragone, Frascati, Italy.
- 2008, January, 21-25 : *RTN Winter School*
on Strings, Supergravity and Gauge Theories,
CERN, Geneva, Switzerland.
- 2007, October, 1-6 : “*Constituents, Fundamental Forces and Symmetries*
of the Universe”
RTN 3rd Workshop,
Valencia, Spain.
- 2007, August, 29 - Sept., 7 : *International School of Subnuclear Physics, 45th Course:*
Search for the “Totally Unexpected” in the LHC Era ,
“*Ettore Majorana*” Foundation and Center for Scientific Culture (EM-FCSC), Erice, Italy.
- 2007, June, 18-22 : ***Member of the Organizing Committee***,
School on Attractor Mechanism,
INFN - Frascati National Laboratories (LNF), Rome, Italy.
- 2007, June, 4-8 : “*String Phenomenology 2007*”,
INFN - Frascati National Laboratories (LNF), Rome, Italy.
- 2006, October, 9-13 : “*Constituents, Fundamental Forces and Symmetries*
of the Universe”
RTN 2nd Workshop and Midterm Meeting ,
Napoli, Italy.
- 2006, September, 18-23 : *XCII National Congress of the Italian Physics Society*,
Torino, Italy.
- 2006, August, 29 - Sept., 7 : ***Invited Scientist***,
International School of Subnuclear Physics, 44th Course:
The Logic of Nature, Complexity and New Physics:
From Quark-Gluon Plasma to Superstrings, Quantum Gravity and Beyond,
“*Ettore Majorana*” Foundation and Center for Scientific Culture (EM-FCSC),
Erice, Italy.
- 2006, March, 20-24 : *Winter School on Attractor Mechanism*,
INFN - Frascati National Laboratories (LNF), Rome, Italy.
- 2006, January, 16-20 : *RTN Winter School*
on Strings, Supergravity and Gauge Theories,
CERN, Geneva, Switzerland.
- 2005, August, 29 - Sept., 7 : ***The Best Student***,
International School of Subnuclear Physics, 43rd Course:
Towards New Milestones in our Quest to go Beyond
the Standard Model,
“*Ettore Majorana*” Foundation and Centre for Scientific Culture (EM-FCSC),
Erice, Italy.
- 2005, June, 6-8 : *The Legacy of Supergravity*,
Conference in honour of Sergio Ferrara, awarded with an Honorary
Degree in Physics by University of Rome “Tor Vergata”,
Villa Mondragone, Monte Porzio Catone (Rome), Italy.

- 2005, March, 14-22** : *Spring School on Superstring Theory and Related Topics*,
The Abdus Salam International Center for Theoretical Physics (ICTP),
Trieste, Italy.
- 2005, March, 7-12** : *Winter School
on Modern Trends in Supersymmetric Mechanics*,
INFN - Frascati National Laboratories (LNF), Rome, Italy.
- 2005, March, 1-4** : *Conference on Higher Dimensional Quantum Hall Effect, Chern-Simons
Theory and Non-Commutative Geometry in Condensed Matter Physics
and Field Theory*, ICTP, Trieste, Italy.
- 2005, January, 31 - February, 4** : *RTN Winter School
on Strings, Supergravity and Gauge Theories*,
Scuola Internazionale Superiore di Studi Avanzati (SISSA), Trieste,
Italy.
- 2002, September, 6-10** : *Villa Mondragone International School
of Gravitation and Cosmology*,
Società Italiana Relatività e Gravitazione (SIGRAV),
Monte Porzio Catone (Rome), Italy.

Seminars and Talks :

- 2022, March, 23** : *Lie Theory in Maxwell-Einstein Gravity*.
Dep.to de Física, Universidad de Murcia, ES.
- 2021, June, 23** : *Theory of invariants in Maxwell-Einstein gravity*.
online talk at LT14 conference.
- 2021, February, 23** : *Il Mondo in 11 Dimensioni (Colloquio su Invito)*.
Scuola di Scienze e Tecnologie, University of Camerino, Camerino, Italy.
- 2019, November, 13** : *On Exceptional Periodicity and Magic Star Algebras*.
DIAS, Dublin, Ireland.
- 2019, September, 25** : *On Exceptional Periodicity and Magic Star Algebras*.
University of Trento, Dept. of Mathematics, Trento, Italy.
- 2019, June, 27** : *On Exceptional Periodicity*.
INRNE, Sofia, Bulgaria.
- 2019, June, 25** : *The Freudenthal Duality Map and New Groups of type E_7* .
INRNE, Sofia, Bulgaria.
- 2019, June, 20** : *The Freudenthal Map and (New) Groups of type E_7* .
BAS, Varna, Bulgaria.
- 2018, July, 11** : *On the (Physics of) Exceptional Periodicity*.
Technical University of Prague, Dept. of Mathematics, Prague, Czech Republic.
- 2018, June, 29** : *On the Magic Star and the Exceptional Periodicity*.
UCLA, Dept. of Astronomy and Physics, Los Angeles, CA, USA.
- 2018, May, 23** : *On Freudenthal Duality*.
University of Murcia, Dept. of Physics, Murcia, Spain.
- 2018, May, 15** : *Freudenthal Duality and (New) Groups of type E_7* .
DIAS, Dublin, Ireland.

- 2018, April, 18 : *The World in Eleven Dimensions (Invited Colloquium)*.
PUCV, Valparaiso, Chile.
- 2018, April, 13 : *Freudenthal Symmetry of Black Hole Entropy*.
Pucon, Chile.
- 2018, March, 8 : *Black Hole Entropy and its Non-Linear Mysteries*.
Geilo, Norway.
- 2018, February, 28 : *Non-Linear Mysteries of Black Hole Entropy*.
Nordita, Stockholm, Sweden.
- 2018, January, 19 : *A Mystery of Black Hole Entropy*.
University of Murcia, Dept. of Physics, Murcia, Spain.
- 2018, January, 9 : *A Black Hole Mystery*.
University of Calabria, Dept. of Physics, Cosenza, Italy.
- 2017, September, 28 : *U-Duality and F-Duality. Linear and Non-Linear Symmetries of Black Hole Entropy*.
University of Trento, TIFPA, Dept. of Physics, Trento, Italy.
- 2017, September, 13 : *A Black Hole Mystery*.
University of Trento, Dept. of Physics, Trento, Italy.
- 2017, July, 8 : *Non-Linear Invariance of Black Hole Entropy*.
Palazzo del Casinó, Venice, Italy.
- 2017, June, 1 : *A Mystery of Black Hole Entropy*.
UB, Dept. of Physics, Barcelona, Spain.
- 2017, May, 22 : *Exceptional Periodicity and the Magic Star*.
Quantum Gravity Research headquarters, Los Angeles, CA USA.
- 2017, April, 28 : *Non-linear anti-involutive symmetries of black hole entropy*.
Mainz Institute for Theoretical Physics, Johannes Gutenberg University, Mainz, Germany.
- 2017, Jan, 12 : *Bekenstein and Hawking meet Jordan and Freudenthal : Non-Linear Symmetries of Black Hole Entropy*.
PUCV, Institute of Physics, Valparaiso, Chile.
- 2016, September, 26 : *Bekenstein and Hawking meet Jordan and Freudenthal : Non-Linear Symmetries of Black Hole Entropy*.
University of Padova, Phys. Dept., Padova, Italy.
- 2016, May, 11 : *Jordan and Freudenthal meet Bekenstein and Hawking : Non-Linear Symmetries of Black Hole Entropy*.
University of Ferrara, Dept. of Physics, Ferrara, Italy.
- 2016, May, 10 : *Bekenstein and Hawking meet Jordan and Freudenthal : Non-Linear Symmetries of Black Hole Entropy*.
University of Bologna, Dept. of Physics, Bologna, Italy.
- 2016, May, 5 : *Almost-Complex Structures for Symplectic Spaces and Non-Linear Symmetries of Black Hole Entropy*.
Centro de Ciencias de Benasque “Pedro Pascual”, Benasque, Spain.
- 2016, April, 11 : *Anti-Involutive Maps for Electromagnetic Fluxes and Non-Linear Symmetries of Black Hole Entropy*.
DIAS, Dublin, Ireland.

- 2016, March, 30** : *Almost-Complex Structures for Electromagnetic Fluxes and Non-Linear Symmetries of Black Hole Entropy.*
University of Genova, Phys. Dept., Genova, Italy.
- 2016, March, 16** : *Almost-Complex Structures for Symplectic Spaces and Non-Linear Symmetries of Black Hole Entropy.*
DISAT, University of Insubria, Como, Italy.
- 2016, February, 23** : *Freudenthal and Exceptional : Symmetries of Gravity and Black Hole Entropy.*
“Statale” Univ. of Milan, Phys. Dept., Milan, Italy.
- 2016, January, 25** : *Quantum Gravity : from Black Holes to Quantum Entanglement.*
“Enrico Fermi” Center, Roma, Italy.
- 2015, December, 1** : *Freudenthal Symmetries and U-Orbits : from Groups of Type E_7 to Pre-Homogeneous Vector Spaces.*
IPhT, CEA, Saclay (Paris), France.
- 2015, November, 24** : *Freudenthal Symmetries and U-Orbits : from Groups of Type E_7 to Pre-Homogeneous Vector Spaces.*
Los Angeles, CA, USA.
- 2015, October, 1** : *Freudenthal Duality, Lie Groups of Type E_7 , and Pre-Homogeneous Vector Spaces.*
Univ. of Bologna, Mathematics Dept., Bologna, Italy.
- 2015, July, 13** : *Freudenthal Duality and Black Holes : from Groups of type E_7 to Pre-Homogeneous Spaces.*
Univ. of Roma “La Sapienza”, Physics Dept., Roma, Italy.
- 2015, April, 28** : *Black Hole Attractors, Charge Orbits and Moduli Spaces.*
CERN, Geneva, Switzerland.
- 2015, March, 5** : *Gravity, Supersymmetry and Attractors.*
“Statale” Univ. of Milan, Phys. Dept., Milan, Italy.
- 2014, November, 7** : *Freudenthal Duality in Gravity: from Groups of Type E_7 to Pre-Homogeneous Spaces.*
IPAM, UCLA, Los Angeles, CA, USA.
- 2014, September, 17** : *The Role of Freudenthal Duality in Gravity: from Groups of Type E_7 to Pre-Homogeneous Spaces.*
Univ. of Genova, Physics Dept., Genova, Italy.
- 2014, September, 9** : *Global Symmetries in (Super)Gravity: Freudenthal Duality, Groups of Type E_7 and Pre-Homogeneous Spaces.*
Univ. of Roma “La Sapienza”, Physics Dept., Roma, Italy.
- 2013, October, 25** : *Groups of Type E_7 in (Super)Gravity: from Freudenthal Duality to Pre-Homogeneous Spaces.*
Univ. of Genova, Physics Dept., Genova, Italy.
- 2013, October 23** : *Dualities Near the Horizon.*
Univ. of Ferrara, Physics Dept., Ferrara, Italy.
- 2013, October 15** : *Freudenthal Duality, Groups of Type E_7 , and Pre-Homogeneous Spaces.*
Univ. of Turin, Theoretical Physics Dept., Turin, Italy.
- 2013, June, 5** : *Dualities Near the Horizon.*
CSIC, Piemonte Orientale Univ., Alessandria, Italy.
- 2013, April, 24** : *Dualities Near the Horizon.*
ITF, KUL, Leuven, Belgium.

- 2013, January, 9** : *Attractive Dynamics and Local Supersymmetry.*
Univ. of Ferrara, Physics Dept., Ferrara, Italy.
- 2012, November, 6** : *Freudenthal Gauge Theory.*
Univ. of Insubria, Como, Italy.
- 2011, November, 17** : *Multi-Centered Black Hole Structures and Groups of Type E_7 .*
IPHT CEA Saclay, Paris, France.
- 2011, November, 11** : *Invariant Structures of Multi-Centered Black Holes.*
“Statale” Univ. of Milan, Phys. Dept., Milan, Italy.
- 2011, June, 1** : *Horizontal Invariants in Multi-Centered Black Holes.*
UCB, Physics Dept., Berkeley, CA, USA.
- 2011, May, 24** : *Multi-Centered Black Holes and Horizontal Symmetry.*
UCLA, Physics and Astronomy Dept., Los Angeles, CA, USA.
- 2010, January, 21** : *Black Attractors.*
“Statale” Univ. of Milan, Phys. Dept., Milan, Italy.
- 2010, January, 12** : *Attractors in Black.*
Univ. of Turin, Theoretical Physics Dept., Turin, Italy.
- 2009, December, 1** : *On the Attractor Mechanism.*
Imperial College, Physics Dept., London, UK.
- 2009, November, 25** : *Attractors in Supergravity.*
King’s College, Mathematics Dept., London, UK.
- 2009, March, 19** : *Moduli Spaces, Charge Orbits and Space-Time.*
Univ. of Minnesota, Fine Theoretical Physics Inst.,
Minneapolis, MN USA.
- 2008, December, 8** : *Attractor Mechanism and Space-Time Singularities.*
Univ. of Cincinnati, Physics Dept., Cincinnati, OH USA.
- 2008, October, 24** : *The Attractor Mechanism in Extremal Black Holes.*
Foundations and Recent Developments.
Univ. of Rome “Tor Vergata”, Physics Dept., Roma, Italy.
- 2006, September, 20** : *Attractors and Black Holes in Supergravity.*
Univ. of Turin, Theoretical Physics Dept., Turin, Italy.
- 2006, February, 27** : *The Attractor Mechanism and Black Holes.*
INFN - Frascati National Laboratories (LNF), Rome, Italy.
- 2002, October, 22** : *CPT Theorem. CPT Violation in Neutral Meson Systems.*
Univ. of Rome “Roma Tre”, “Edoardo Amaldi” Physics Dept.
- 2002, October, 6** : *Elements of Gauge Theories. Physical Consistence of Gauge Group.*
Univ. of Rome “Roma Tre”, “Edoardo Amaldi” Physics Dept.
- 2002, October, 14** : *Elements of Theory of Algebras. From Poincar-Birkhoff-Witt Theorem to Baker-Campbell-Hausdorff formula.*
Univ. of Rome “Roma Tre”, “Edoardo Amaldi” Physics Dept.
- 2002, August, 31** : *Hamilton’s Quaternionic R -algebra and the Rotations in R^3 .*
Univ. of Rome “Roma Tre”, “Edoardo Amaldi” Physics Dept.

Reviewer Activity

1. PLB (Physics Letters B) (*The Best Reviewer 2011*);

2. CQG (Classical and Quantum Gravity);
3. LMP (Letters in Mathematical Physics);
4. EPJ+ (European Physics Journal Plus);
5. EPJC (European Physical Journal C);
6. Il Nuovo Cimento;
7. JHEP (Journal of High Energy Physics);
8. NPB (Nuclear Physics B);
9. SIGMA (Symmetry, Integrability and Geometry : Methods and Applications);
10. JGSP (Journal of Geometry and Symmetry in Physics);
11. JGP (Journal of Geometry and Physics);
12. JPA (Journal of Physics A : Mathematical and Theoretical);
13. IJGMMP (International Journal of Geometric Methods in Modern Physics);
14. Mathematical Reviews (AMS);
15. Filomat;
16. RACSAM (Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales. Serie A. Matemáticas).
17. FUJMA (Fundamental Journal of Mathematics and Applications).
18. Reviewer *ad honorem* within Regular FONDECYT National Projects Competition (Chile).
19. Communications in Algebra.

Piacenza, 20/04/2022

Alessio Marrani

Curriculum Vitae

ALESSIO NOTARI

OMISSIS

email: OMISSIS

- Data e Luogo di nascita: OMISSIS

Esperienza lavorativa accademica

- Dal 27/06/2017 **Professore in Fisica** presso **Universitat de Barcelona** (Spagna), (“Professor Agregat”), Departament de Física Quàntica i Astrofísica, & Institut de Ciències del Cosmos (ICCUB)
- 12/2016 – 26/06/2017 **Ricercatore e Docente “tenure-track” in Fisica** presso **Universitat de Barcelona** (Spagna), Departament de Física Quàntica i Astrofísica, nel programma “**Ramon y Cajal - Retencion del Talento**”,
- 12/2013 – 11/2016 **Ricercatore** in Fisica a Tempo Determinato (RTDa, FIS/02-02/A2), **Università di Ferrara**, Dipartimento di Fisica e Scienze della Terra, (In congedo dal 15/09/2014 al 02/03/2015, dal 01/07/2015 al 14/02/2016, e dal 16/05/2016 al 30/11/2016, presso Universitat de Barcelona come ricercatore “Ramon y Cajal”. Contratto presso Università di Ferrara concluso il 30/11/2016.)
- 12/2010-11/2013 **Ricercatore e Docente “tenure-track” in Fisica** presso **Universitat de Barcelona**, Departament de Física Fonamental, nel programma “**Ramon y Cajal**”.
Il programma quinquennale “*Ramon y Cajal*” spagnolo è basato su una selezione a livello nazionale in Spagna. Le singole università assumono i vincitori della selezione, a condizione di prendere da subito l’impegno di aprire una posizione permanente nella stessa area al termine del programma.

CONTRATTI POSTDOC/RESEARCH FELLOW:

- 01/2010 – 07/2010 **“Scientific Associate”** in Cosmologia e Fisica Teorica, Institute of Theoretical Physics (ITP), **Università di Heidelberg** (Germania)
- 10/2007 – 12/2009 **Research “Fellow”** presso il **C.E.R.N.**, (Ginevra, Svizzera), Divisione Teorica, Cosmologia e Fisica Teorica
- 09/2004 - 08/2007 **Ricercatore post-dottorale** presso la **McGill University** (Montréal, Canada), High Energy Physics group, Cosmologia e Fisica Teorica.

Attività Didattica

Univ. di Ferrara: **Istituzioni di Metodi Matematici della Fisica (teoria e esercitazioni)**
Primavera 2014 (6 ECTS), Primavera 2015 (9 ECTS), Primavera 2016 (9 ECTS)

Univ. di Barcelona: **Advanced Cosmology** (teoria), Master in “Fisica delle Particelle, Astrofisica e Cosmologia”. Autunno 2012 (20 ore), Autunno 2015 (15 ore), Autunno 2016 (15 ore), Autunno 2017 (15 ore), Autunno 2018 (15 ore), Autunno 2019 (15 ore), Autunno 2020 (30 ore), Autunno 2021 (30 ore)

Calcolo (Analisi matematica) in una variabile (teoria)
corso di laurea in Fisica, Autunno 2015 (45 ore), Autunno 2016 (45 ore), Autunno 2017 (45 ore), Autunno 2018 (45 ore), Autunno 2019 (45 ore), Autunno 2020 (45 ore), Autunno 2021 (45 ore)

Calcolo (Analisi matematica) in una variabile
(esercitazioni), corso di laurea in Fisica, Autunno 2016 (15 ore), Autunno 2017 (45 ore), Autunno 2018 (15 ore), Autunno 2019 (15 ore), Autunno 2020 (15 ore),

Metodi matematici della Fisica 1
(teoria e esercitazioni), corso di laurea in Fisica, Autunno 2020 (60 ore)

Meccanica Quantistica
(esercitazioni), corso di laurea in Fisica, Primavera 2016 (15 ore)

Algebra Lineare
(esercitazioni), corso di laurea in Ingegneria Biomedica e Ingegneria Elettronica e Telecomunicazioni, Autunno 2017 (15 ore), Autunno 2018 (15 ore), Autunno 2019 (15 ore)

Fondamenti di Meccanica (esercitazioni), corso di laurea in Fisica, 2011/2012 (13 ore), 2012/2013 (15 ore), 2021 (15 ore)

Onde Fluidi e Termodinamica (esercitazioni), corso di laurea in Ingegneria Elettronica, 2014/2015 (15 ore)

Fondamenti di Meccanica e Onde (esercitazioni), corso di laurea in Ingegneria Chimica, Autunno 2016 (15 ore), Autunno 2017 (15 ore), Autunno 2019 (15 ore)

Fisica Generale (esercitazioni), corso di laurea in Chimica, Autunno 2018 (15 ore), Autunno 2019 (15 ore), 2021 (30 ore, esercitazioni e coordinazione)

Fisica Generale (laboratorio), corso di laurea in Chimica, Autunno 2018 (12 ore)

Fisica Generale (esercitazioni, facoltà di Biologia), 2014/2015 (13 ore), 2013/2014 (27 ore), 2012/2013 (30 ore), 2011/2012 (25 ore)

Laboratorio di Meccanica, corso di laurea in Fisica 2011/2012 (48 ore), 2010/2011 (15 ore)

Calcolo in più variabili (esercitazioni), corso di laurea in Fisica: '14/'15 (15 ore), Autunno 2017 (15 ore), Autunno 2018 (15 ore), Autunno 2019 (15 ore) nel corso di laurea in Ingegneria Elettronica: '14/'15 (15 ore),

TOTALE ORE DI LEZIONE: 1280

Invited Lecturer: - Invitato per dare lezioni su “**Cosmology of scalar fields**”, **Università di Padova** (2 ore di lezione) nell’ambito del corso di Dottorato in Fisica, 02/2019
- Invitato per dare lezioni su “**Axions**”, **Università di Padova** (6 ore di lezione) nell’ambito del corso “Astroparticle Physics”, Maggio 2018
- Invitato per dare lezioni su “Cosmology” presso “**TAE 2017, International Summer School on High Energy Physics**”, Sep. 03 –16, (Benasque, Spagna)
- Invitato per dare lezioni presso la **IPM Cosmology School and Workshop** (ICSW07) Giugno 2 - 9, 2007 Tehran - IRAN.

RELATORE DI TESI:

- Presso **McGill University**:

1. Co-supervisione di tesi di Bachelor in Fisica. 2005. candidato: William Witczak-Krempa, titolo: “On generation of cosmological magnetic fields from density perturbations”

- **Tesi di Master** in “Fisica delle Particelle, Astrofisica e Cosmologia”, **Universitat de Barcelona**:

1. 2011, candidato: Ramon Nogueira, titolo: “Constraining the Higgs mass from the post inflationary evolution of a False Vacuum Inflation model ”
2. 2015, candidato: Alejandro Alfonso, titolo: “ On the generation of magnetic fields in Standard Model Higgs Inflation ”
3. 2018 : Fabian Wagner “Quantum Tunneling after Inflation”
4. Giugno 2019 : Ander Mazquiaran, “On Tunneling in Higgs Inflation”
5. Settembre 2019, Carlos Franchy, “Black Holes from Inflationary Phase Transitions”
6. Settembre 2019, Ariday Bordon, “Scalar particle production during Axion inflation”
7. 2020, Angel Gil Muyor, “False Vacuum Inflation with non-minimal coupling”
8. 2020, Antoni Bertolez Martinez, “Dark Matter from Inflaton - Higgs coupling”

- **Tesi di Laurea** presso **Universitat de Barcelona** (“Trabajo de Fin de Grado”):

1. 2017, candidato: Daniel Lozano Gomez, , titolo: “ On Reheating after Inflation ”
2. 2018, candidato: Guillem Simeon, titolo: “On Natural Inflation” (10/10, “Matricula de Honor”)
3. Giugno 2019, candidato: Jon Garí Galíndez , titolo: “ Natural Inflation with two light quarks”
4. Luglio 2021, candidato: Pau Martínez Marín, titolo: “On Natural Inflation with an Extra Scalar Field” (in corso)
5. Luglio 2021, candidato: Albert Civit Bertran , titolo: “ Evolution of a non-minimally coupled scalar field in a LTB metric” (in corso)

- **Tesi di Laurea Magistrale** in “Fisica”, **Università di Padova**:

1. Giovanni Pierobon, 2019 (ruolo: Correlatore, argomento: Assioni Termici in Cosmologia) (30/30, *cum laude*)

Formazione

- 06/2005 Perfezionamento (equipollente a **Dottorato di Ricerca**) in **Fisica** (Cosmologia e Fisica Teorica delle Alte Energie) presso la **Scuola Normale Superiore (Pisa)**: *70/70 cum laude*.
Titolo della Tesi: “Thermal Leptogenesis in the Early Universe and Bounds on Neutrino Masses”
- 11/2002 **Diploma di Licenza in Fisica** presso la **Scuola Normale Superiore**, Pisa: *70/70 cum laude*
Media agli esami presso la Scuola Normale Superiore: $\hat{29.5}/30$
- 11/2001 **Laurea in Fisica** presso la **Università di Pisa**: *110/110 cum laude*
Media agli esami presso la Università di Pisa: *29.2/30*
- 1992 – 1997 Diploma di Maturità presso il Liceo Scientifico “Lazzaro Spallanzani” (Reggio Emilia) (*60/60*).

Attività di: Ricerca, Organizzazione, Divulgazione

- **Research Activities**

<i>Keywords</i>	<i>Breve Descrizione</i>
Bariogenesi	Studio degli effetti di teoria dei campi a temperature finita nella Leptogenesi, studio dei bound sulla massa dei neutrini
Inflazione	Modelli primordiali di inflazione da tunneling quantistico, in teorie scalar-tensor, con produzione di onde gravitazionali dovute a transizioni di fase. Reheating, effetti di temperatura finita.
Perturbazioni Cosmologiche	Effetti di scelta del vuoto quantistico. Curvatone e perturbazioni di isocurvatura. Effetti di velocità peculiare.
Dark Energy	Studio della “backreaction” delle inhomogeneità sulla espansione dell’Universo, modelli LTB, alternativi alla dark energy
Higgs e Inflazione	Modelli primordiali di inflazione con il campo di Higgs tramite tunneling quantistico
CMB	Effetti e misurazione di velocità peculiare, effetti su calibrazione degli esperimenti. Anomalie a grandi scale, modulazione dipolare, allineamenti di multipoli. Alternative a Λ CDM.
Assioni in Inflazione	Axion inflation, modelli dissipativi. Natural Inflation
QCD Axion	Produzione termica di relic QCD Axion, come “Dark radiation” Domain walls e onde gravitazionali
Fisica di Precisione	Effetti sistematici e di GR nelle misure del $g - 2$ del muone
Statistica e Analisi Dati	Analisi epidemiologiche COVID-19

- **64 articoli scientifici pubblicati su riviste internazionali**

, di cui:

- **46 articoli, in Cosmologia e fisica teorica, in piccole collaborazioni (con numero di autori minore o uguale a 6) o a firma individuale**
- **16 articoli con grande numero di autori, nelle Collaborazioni Scientifiche CORE** (esperimento proposto per la misura del Cosmic Microwave Background), **IAXO** (esperimento proposto per la rivelazione di assioni) e nella Collaborazione SNOWMASS2021 - Cosmology Intertwined.

Pubblicati nelle seguenti riviste:

- * “Physical Review Letters”,
- * “Physical Review D”,
- * “Journal of Cosmology and Astroparticle Physics” (JCAP),
- * “Journal of High Energy Physics” (JHEP),
- * “Nuclear Physics B”,
- * “Modern Physics Letters”,
- * “Classical and Quantum Gravity”
- * “Astroparticle Physics”
- **2 articoli** in statistica e epidemiologia, pubblicati su “Science of the Total Environment” e su “Pathogens and Global Health”

- **Citazioni** per lavori in Fisica pubblicati con peer-review, da www.inspirehep.net (al 11/04/2022):

- 1 articolo con 800+ citazioni
- 17 articoli con numero di citazioni nel range 100-249
(11 articoli, escludendo gli articoli in Collaborazioni con numero maggiore di 6 autori)
- 6 articoli con numero di citazioni nel range 50-99
(5 articoli, escludendo gli articoli in Collaborazioni con numero maggiore di 6 autori)
- 33 articoli con numero di citazioni nel range 10-49
(24 articoli, escludendo gli articoli in Collaborazioni con numero maggiore di 6 autori)
- Numero totale di citazioni: **4443**
(3,268, escludendo gli articoli in Collaborazioni con numero maggiore di 6 autori)
- Numero medio di citazioni per articolo: **71.7**
(71, escludendo gli articoli in Collaborazioni con numero maggiore di 6 autori)
- Indice h_{HEP} : **32**
(28, escludendo gli articoli in Collaborazioni con numero maggiore di 6 autori)

- **Citazioni** per lavori da Google Scholar (al 11/04/2022): **4900**

- Indice h : **34**

-
- **Membro della collaborazione** scientifica internazionale “**CORE Collaboration**” (2016-2017), per il satellite CORE (Cosmic Origins Explorer) per la misura della Radiazione Cosmica di Fondo, recentemente proposto alla Agenzia Spaziale Europea (ESA).
 - **Membro della collaborazione** scientifica internazionale per l’esperimento IAXO (“International Axion Observatory”), proposto per la rivelazione di **Assioni**.
 - **Abilitazioni e altri riconoscimenti:**
 - Abilitazione al ruolo di “Professor Agregat” (AQU), “**Acreditació de Recerca**” della “Agència per a la Qualitat del Sistema Universitari de Catalunya” (29/09/2014).
 - Abilitazione Italiana (ASN) come “**Professore di Seconda Fascia**”, Fisica Teorica (FIS 02/A2), 08/01/2014. Rinnovo ottenuto il 07/01/2020, valido fino al 07/01/2029.
 - Abilitazione Italiana (ASN) come “**Professore di Prima Fascia**”, Fisica Teorica (FIS 02/A2), Dal 14/04/2021, valido fino al 14/04/2030.
 - Valutazione positiva nel programma “**I3**”, Agencia Nacional de Evaluación y Prospectiva (ANEP, Spain), 15/12/2014.
 - Abilitazione Francese come “**Maître de Conférences**”, in Physics, section “Constituants elementaires” (2008).
 - “Honorable Mention Essay”, Gravity Research Foundation, Titolo: “*A Graceful Exit for Old Inflation and a Solution to the Hierarchy Problem*”.
 - **Visiting Scholar:**
 - Visita scientifica presso IFPU (Sissa, Trieste), 03/2022-04/2022.
 - Visita scientifica presso Dipartimento di Fisica, Università di Padova, 01/2020-07/2020 (sospesa causa COVID).
 - Visita scientifica presso Dipartimento di Fisica, Università di Padova, circa 5 mesi e mezzo totali tra Gennaio e Luglio 2019.
 - Borsa “Visiting Scientist”, Università di Padova, Aprile-Giugno 2018. Durata totale della visita scientifica: , circa 5 mesi e mezzo totali tra Marzo e Luglio 2018.
 - “Short Term Visitor”, con borsa, C.E.R.N., Geneva, Switzerland (Theory Group), 1 settimana, Luglio 2017.
 - “Short Term Visitor”, con borsa, C.E.R.N., Geneva, Switzerland (Theory Group), 7 settimane, Febbraio/Marzo 2016.
 - Universidad Federal do Rio de Janeiro (UFRJ, Brazil). Visitor, 2 settimane, con borsa, Febbraio 2014.
 - Université de Genève e C.E.R.N., Theory Division, Genève, Switzerland. Visitor, Marzo - Luglio 2004.
 - **Partecipazione a Progetti di Ricerca:**

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- Titolo: “Física de axiones en cosmología, métodos de detección astrofísicos, y desarrollo de componentes instrumentales de BABYIAXO”, Spanish Ministry of Science and Innovation, Proyectos I+D Generación de Conocimiento. Ref: PID2019-108122GB-C32. Dates: from 2020. **Principal Investigators: Jordi Miralda Escudé, Alessio Notari.** Totale: 89.200 euro
 - Titolo: “Teoría y fenomenología de las interacciones fundamentales: Gravitación y Cosmología”, Spanish Ministry of Science and Innovation . Ref: FPA2016-76005-C2-2-P. Date: 30/12/2016-29/12/2019. Numero di ricercatori: 7. Totale: 211.750 euro.
 - Titolo: “Gravitation, Strings, and Cosmology ”, Ref: 2017SGR754. Agència de Gestió d’Ajuts Universitaris i de Recerca (AGAUR). Dates: 01/01/2017-31/12/2019. Numero di ricercatori: 23. Totale: 65.896 euro.
 - Titolo: “Teoría y fenomenología de las interacciones fundamentales: Gravitación y Cosmología”. Ref: FPA2013-45670-C2-2-P. Dal 2014 al 2016. Totale: 175.000 euro.
 - Titolo: “Teoría y fenomenología de las interacciones fundamentales: Gravitación y Cosmología”. Ref: FPA2010-20807-C02-02. Dal 2011 al 2013. Numero di ricercatori 9. Totale: 212.900 euro.
 - Titolo: “Teoría y fenomenología de las interacciones fundamentales: Gravitación y Cosmología”, Spanish Ministry of Science and Innovation, Ref: FPA2007-66665-C02-02. Anno 2010.
 - Titolo: “Gravitation, Strings, and Cosmology ”, Ref: 2009SGR168. Agència de Gestió d’Ajuts Universitaris i de Recerca (AGAUR). Date: 2009-2013. Numero di ricercatori con titolo di Dottorato: 14. Totale: 44.720 euro.
 - Titolo: “Gravitation, Strings, and Cosmology ”, Ref: 2014 SGR 1474. Agència de Gestió d’Ajuts Universitaris i de Recerca (AGAUR). Date: 2014-2016. Numero di ricercatori con titolo di Dottorato: 12. Totale: 43.000 euro.
 - Titolo: “INDARK”, research for Astro-Particle Physics, Istituto Nazionale di Fisica Nucleare (INFN, Italy). Dal 2014 al 2015. Numero di ricercatori: $\simeq 60$. Totale: $\simeq 80K$ euro per anno.
 - Titolo: “Iniziativa specifica PD51, on: Inflation, Dark Matter and Large Scale Structure of the Universe”. Istituto Nazionale di Fisica Nucleare (INFN, Italy). Dal 2002 al 2005. PI: Sabino Matarrese.
 - Titolo: “Iniziativa specifica PI21, on: Field Theories and Model Building of Elementary Particles”. Istituto Nazionale di Fisica Nucleare (INFN, Italy). Dal 2002 al 2005. PI: Riccardo Barbieri.
 - “Subvenció per a la contractació d’investigadors dins del Programa Ramon y Cajal”. Include 15.000,00 euro addizionali nel primo anno. Ref: RYC-2010-07369. Numero di ricercatori: 2. 192.480,00. Principal Investigator: Jaime Garriga Torres; Alessio Notari. Date: 05/11/2010-04/11/2015.
 - Titolo: “Ajuts en el marc del Programa de Retenció del Talent 2015” . Principal Investigator: Alessio Notari. Date: 01/12/2015-30/09/2017.

- **Organizzazione di Conferenze:**

- Co-organizzatore del workshop di Cosmologia, “*The vacuum of the Universe: from cosmology to particle physics*”, Instituto de Ciencias del Cosmos (ICCUB), Universitat de Barcelona, 4-6 Giugno 2018.
- Organizzatore principale della scuola di Cosmologia, “*ICCUB Cosmology School: Hot Topics in Cosmology*”, Instituto de Ciencias del Cosmos (ICCUB), Universitat de Barcelona, 23-26 Ottobre 2017.
- Membro della Local Organizing Committee, “*Meeting on Fundamental Cosmology*”, Instituto de Ciencias del Cosmos (ICCUB), Universitat de Barcelona, 15-17 Giugno 2016.
- Membro della Organizing Committee, “*Christmas Meeting*”, Instituto de Ciencias del Cosmos (ICCUB), Universitat de Barcelona, December 2014.

- **Responsabilità Istituzionali:**

- 2017-2020, Organizzatore dei Seminari Interni, Universitat de Barcelona.
- 2014, 2017, 2018 (gennaio), 2018 (luglio), 2021 (Febbraio): Membro della Commissione di valutazione tesi di Laurea; Universitat de Barcelona.
- Membro della Commissione di valutazione tesi di Master; Universitat de Barcelona (06/2012 e 06/2013)
- 2005-2007, Organizzatore dei Seminari, McGill University (Montreal, QC, Canada).

- **Supervisioni:**

- Supervisione di ricercatori post-dottorali: Ricardo Z.Ferreira (Universitat de Barcelona, 09/2016-09/2018), Mohammed Ali-Gorji (Universitat de Barcelona, inizio previsto in Aprile 2022)

- **Referee per le seguenti Riviste Scientifiche:**

- *Fisica*: “Physical Review Letters”, “Journal of Cosmology and Astroparticle Physics”, “Journal of High Energy Physics”, “The Astrophysical Journal”, “Monthly Notices of the Royal Astronomical Society”, “Classical and Quantum Gravity”, “Physics of the Dark Universe”, “Physical Review D”, “Publications of the Astronomical Society of Australia”;
- *Analisi dati epidemiologiche*: “Environmental Research”, “GeoHealth”.

- **Divulgazione Scientifica:**

- Partecipazione alla realizzazione e organizzazione della esibizione di Posters (per scuole e pubblico non specializzato):
“*Unravelling the Dark Universe*”, ICCUB (Università di Barcelona),
<http://serviastro.am.ub.edu/twiki/bin/view/ServiAstro/UniversFosc>

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- McGill University : Assistente all’insegnamento per il corso “*Space, Time and Matter*”, corso rivolto a studenti di tutte le facoltà, anche umanistiche, con finalità divulgative (alcune ore di lezione e ricevimento studenti) Sett.- Dic. '05

● **Seminari e Conferenze :**

- “ *Cosmic Axion Background: The QCD Axion as a Hot Relic*”
 - * IFPU (SISSA), Trieste, March 2022
 - * ”Winter meeting”, Universitat de Barcelona, February 2022
 - * COSMO '21, University of Illinois, online conference, August 2021
 - * PASCOS 2021, Seoul, Korea, online conference, June 2021
 - * PPC 2021, 14th International online Conference on Interconnections between Particle Physics and Cosmology, presso: University of Oklahoma, Norman, May 2021.
- “*Attempting to alleviate the H_0 tension with physically motivated models*”
 - * Invited talk nella serie INFN on-line “Newton 1665” seminars – phenomenology/theory/astro/cosmo”, <https://agenda.infn.it/event/22106/>, Giugno 2020
 - * Invited talk presso Università di Padova, Dipartimento di Fisica, online seminar, Maggio 2020
- “ *Hot Axions and the H_0 tension*”
 - * Istituto de Fisica de Altes Energies (IFAE), Barcelona, Universitat Autònoma, Giugno 2019
 - * Invited speaker al workshop “Light scalars: origin, cosmology, astrophysics and experimental probes”, Bidasoa (Spagna), Aprile 2019
- “ *Observable windows for the QCD Axion as a Hot Relic*”
 - * Università di Parma, Maggio 2019
 - * “Workshop on the Standard Model and Beyond”, Corfu (Grecia), 09/2018
- “ *Peculiar Velocity Effects and CMB Anomalies*”
 - * Invited speaker all’ “ASI-Cosmo Meeting”, Università di Ferrara (Italia), Giugno 2018,
- “*False Vacuum Inflation*”: Seminario alla Conferenza “Cosmological probes of BSM - from the Big Bang to the LHC”, Bidasoa (Spagna), May 2018
- “*Cosmology and Fundamental Physics*”: Invited speaker, Colloquio at University of Trieste, April 2018
- “*QCD Axions as Dark Radiation*”:
 - * Università di Padova (Italia), Aprile 2018
- “*On Axions in Inflation and as Hot Relics*”:

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- * Moriond Cosmology 2018, La Thuile (Italia), Marzo 2018
 - * “ASI-Cosmo Meeting”, Università di Padova (Italia), Febbraio 2018,
 - *“Inflation with Thermalization and Dissipation”*:
 - * COSMO Conference, Paris, Agosto 2017
 - * European Physical Society Conference on High Energy Physics (EPS-HEP), Venezia, Luglio 2017
 - * C.E.R.N. (Geneve), Luglio 2017
 - * PASCOS Conference 2017, University of Madrid (UAM-IFT), Giugno 2017
 - *“Inflation with Dissipation and Metastability”*:
 - * ICTP, Trieste (Italy), Settembre 2016
 - * Workshop “The Big Bang and the little bangs” presso C.E.R.N. (Geneva, Switzerland, Agosto 2016)
 - *“Hemispherical Power Asymmetry and Peculiar Velocity Effects in Planck CMB”*
 - * Workshop “Cosmic Microwave Background, Large Scale Structure and 21 cm Surveys” (IFT/UAM, Madrid, Spain, Giugno 2016)
 - * Galileo Galilei Institute (GGI) Workshop: “ Theoretical Cosmology in the Era of Large Surveys” (Firenze, Italy), April 2016
 - * “Rencontres de Moriond-Cosmology 2016” (La Thuile, Italy), Marzo 2016
 - * C.E.R.N. (Geneve), Feb 2016
 - * ‘COSMO 2015’, Warsaw (Poland), Luglio 2015
 - * ‘Invisibles15 Workshop’, Madrid (Spain), Giugno 2015
 - * “Meeting on Fundamental Cosmology”, Giugno 2015, Santander (Spain)
 - * University of Heidelberg (Germany), Sep 2014
 - “Planck Anomalies and Peculiarities”,
 - * PASCOS Conference 2014, University of WARSAW, Giugno 2014
 - * ICTP/SAIFR, São Paulo (Brasile), Feb 2014
 - * University of Heidelberg, Luglio 2013
 - * University of Barcelona (Spain), Maggio 2013
 - * Conference CosmoRENATA, Universidad de Valencia, Giugno 2013
 - “Predicting the Higgs mass from Inflation”,
 - * Università di Padova, Mar 2014
 - * ICTP/SAIFR, São Paulo (Brasile), Feb 2014, Invited speaker at “Miniworkshop on Cosmology”
 - * Università di São Paulo (Brasile), Feb 2014
 - * Università Federale di Rio de Janeiro , UFRJ, (Brasile), Feb 2014. Invited speaker at “Ciclo de Palestras 50 anos do Instituto de Física”.
 - * University of Heidelberg (Germany), Sept 2012

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- * Ludwig Maximilian University (LMU), Munich (Germany), Maggio 2012
 - * Universitat Autònoma de Barcelona (Spain), April 2012
 - * Universitat de Barcelona (Spain), Feb 2012
 - * Universidad Autónoma de Madrid-IFT (Spain) Gen.2012
 - * Universidad de Salamanca (Spain) Feb.2012
 - “Measuring our local velocity with CMB correlations”,
 - * Università di Ferrara (Italia) April 2011
 - * University of Heidelberg (Germany), Feb 2011
 - “Local Void vs. Dark Energy and the WMAP Cold Spot”:
 - * Workshop “The Nature of Dark Energy”, (IFT), Universidad Autónoma de Madrid, Giugno 2011
 - * Instituto de Física Teórica (IFT), Universidad Autónoma de Madrid, Giugno 2010
 - * Universitat de Barcelona (Spain), Giugno 2010
 - * Max-Planck Institut, Heidelberg (Germany), Giugno 2009
 - * ”Planck 2009” International Conference, Padova Maggio 2009.
 - * C.E.R.N., Giugno 2009
 - “Can a Local Void mimic Dark Energy?”:
 - * Invited Speaker at the Workshop “Is the Universe really undergoing Accelerated Expansion?”, KEK, Tsukuba, Japan, Dec 2008.
 - * Invited Plenary Speaker at the International Conference “Progress in Old and New Themes in Cosmology”, Avignon (France), April 2008.
 - * Université Libre de Bruxelles, Feb.2008
 - * C.E.R.N., Genève, Nov. 2007
 - “A graceful Exit for old Inflation and a Solution to the Hierarchy problem”:
 - * Université de Lausanne (EPFL), Aprile 2008
 - * Université de Paris 7 (APC), Marzo 2008
 - * Université de Genève, Febbraio 2008
 - * C.E.R.N. (Genève), Luglio 2007
 - * University of Toronto, Gennaio 2006.
 - * Fermilab, Theoretical Astrophysics (Chicago), Marzo 2006.
 - * Harvard University (Boston), Febbraio 2006.
 - * Columbia University (New York), Febbraio 2006.
 - * Princeton University (NJ), Febbraio 2006.
 - * Perimeter Institute for Theoretical Physics, Waterloo (ON), Feb. 2006.
 - * McGill University(Montreal), Giugno 2006
 - * Conference “Cosmology 2005: a reality check”, Copenhagen, Niels Bohr Institute, Dicembre 2005.

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- “Nonlinear Structure Formation and Apparent Acceleration: an Investigation”,
 - * Conferenza Internazionale “Key Approaches on Dark Energy”, Agosto 07-15 2006, Barcelona, Spain
 - * “Excursions in the Dark Workshop - 2007”, at Perimeter Institute for Theoretical Physics, Waterloo (ON), 19/05/2007
 - “Viable First-Order (Extended) Inflation” alla “International Conference On Particle Physics And Cosmology: COSMO’05”, Agosto - Settembre 2005, Bonn, Germany
 - “The expansion rate in a inhomogeneous universe”:
 - * Cornell University, Aprile 2005
 - * William I. Fine Theoretical Physics Institute, University of Minnesota, 02/2005
 - “*Constraints on neutrino masses from leptogenesis*”, McGill University, 10/’04

LINGUE CONOSCIUTE

- **Italiano** (lingua madre)
- **Inglese** (ottimo, scritto e parlato)
- **Francese** (ottimo, scritto e parlato)
- **Spagnolo** (ottimo, scritto e parlato)
- **Polacco** (elementare)
- **Tedesco** (principiante)
- **Catalano** (ottima comprensione, livello parlato avanzato)

ABILITÀ INFORMATICHE

- Sistemi operativi: MacOS-X, Windows, Linux/Unix.
- MS Office.
- Programmazione con Mathematica (software per applicazioni matematiche), esperienza di programmazione in Fortran/Python/C.
- Esperienza in presentazioni: LaTeX, PowerPoint.

Lista di tutte le Pubblicazioni

Articoli pubblicati e preprints, lista disponibile nel sito: <http://inspirehep.net/> e Google Scholar.

1. **“High Quality QCD Axion at Gravitational Wave Observatories,”**
R. Z. Ferreira, A. Notari, O. Pujolàs and F. Rompineve,
[arXiv:2107.07542 [hep-ph]]. Phys.Rev.Lett. 128 (2022) 14, 141101.
2. **“The DFSZ axion in the CMB ”,**
R. Z. Ferreira, A. Notari and F. Rompineve,
[arXiv:2012.06566 [hep-ph]]. Physical Review D (Vol. 103, No. 6), DOI: 10.1103/PhysRevD.103.063524
3. **“Production of Thermal Axions across the ElectroWeak Phase Transition,”**
F. Arias-Aragon, F. D’Eramo, R. Z. Ferreira, L. Merlo and A. Notari,
[arXiv:2012.04736 [hep-ph]]. JCAP 03(2021)090
4. **“Conceptual Design of BabyIAXO, the intermediate stage towards the International Axion Observatory,”**
A. Abeln *et al.* [BabyIAXO Collaboration], Journal of High Energy Physics volume 2021, Article number: 137 (2021).
5. **“Cosmology intertwined III: $f\sigma_8$ and S_8 ,”**
E. Di Valentino, L. A. Anchordoqui, Ö. Akarsu, Y. Ali-Haimoud, L. Amendola, N. Arendse, M. Asgari, M. Ballardini, S. Basilakos and E. Battistelli, *et al.*
Astropart. Phys. **131** (2021), 102604
doi:10.1016/j.astropartphys.2021.102604
6. **“Snowmass2021 - Letter of interest cosmology intertwined IV: The age of the universe and its curvature,”**
E. Di Valentino, L. A. Anchordoqui, Ö. Akarsu, Y. Ali-Haimoud, L. Amendola, N. Arendse, M. Asgari, M. Ballardini, S. Basilakos and E. Battistelli, *et al.*
Astropart. Phys. **131** (2021), 102607
doi:10.1016/j.astropartphys.2021.102607
7. **“Snowmass2021 - Letter of interest cosmology intertwined I: Perspectives for the next decade,”**
E. Di Valentino, L. A. Anchordoqui, O. Akarsu, Y. Ali-Haimoud, L. Amendola, N. Arendse, M. Asgari, M. Ballardini, S. Basilakos and E. Battistelli, *et al.*
Astropart. Phys. **131** (2021), 102606
doi:10.1016/j.astropartphys.2021.102606
8. **“Snowmass2021 - Letter of interest cosmology intertwined II: The hubble constant tension,”**
E. Di Valentino, L. A. Anchordoqui, O. Akarsu, Y. Ali-Haimoud, L. Amendola, N. Arendse, M. Asgari, M. Ballardini, S. Basilakos and E. Battistelli, *et al.*

Astropart. Phys. **131** (2021), 102605
doi:10.1016/j.astropartphys.2021.102605

9. **“Cosmic Imprints of XENON1T Axions”**
F. Arias-Aragon, F. D’Eramo, R. Z. Ferreira, L. Merlo and A. Notari.
JCAP 11 (2020) 025
<https://iopscience.iop.org/article/10.1088/1475-7516/2020/11/025>
10. **“COVID-19 transmission risk factors”**
A. Notari and G. Torrieri.
arXiv:2005.03651 [q.bio], medRxiv 2020.05.08.20095083;
Pathogens and Global Health, DOI: 10.1080/20477724.2021.1993676
11. **“The H_0 tension: ΔG_N vs. ΔN_{eff} ”**
G. Ballesteros, A. Notari and F. Rompineve.
JCAP 11 (2020) 024
<https://iopscience.iop.org/article/10.1088/1475-7516/2020/11/024>
12. **“Temperature dependence of COVID-19 transmission”**
A. Notari.
Science of The Total Environment, Volume 763, 2021,144390,
doi: <https://doi.org/10.1101/2020.03.26.20044529>
13. **“On systematic and GR effects on muon g - 2 experiments”**
A. Notari and D. Bertacca.
arXiv:1905.03649 [hep-ph]
DOI:10.1007/JHEP11(2019)030
JHEP **1911**, 030 (2019)
14. **“Physics potential of the International Axion Observatory (IAXO)”**
E. Armengaud *et al.* [IAXO Collaboration].
arXiv:1904.09155 [hep-ph]
DOI:10.1088/1475-7516/2019/06/047
JCAP **1906**, no. 06, 047 (2019)
15. **“Hot Axions and the H_0 tension”**
F. D’Eramo, R. Z. Ferreira, A. Notari and J. L. Bernal.
arXiv:1808.07430 [hep-ph]
DOI:10.1088/1475-7516/2018/11/014
JCAP **1811**, no. 11, 014 (2018)
16. **“Natural Inflation with a periodic non-minimal coupling”**
R. Z. Ferreira, A. Notari and G. Simeon.
arXiv:1806.05511 [astro-ph.CO]
DOI:10.1088/1475-7516/2018/11/021
JCAP **1811**, no. 11, 021 (2018)

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17. **“Observable windows for the QCD axion through the number of relativistic species”**
R. Z. Ferreira and A. Notari.
arXiv:1801.06090 [hep-ph]
DOI:10.1103/PhysRevLett.120.191301
Phys. Rev. Lett. **120**, no. 19, 191301 (2018)
 18. **“Thermalized axion inflation: natural and monomial inflation with small r ”**
R. Z. Ferreira and A. Notari.
arXiv:1711.07483 [astro-ph.CO]
DOI:10.1103/PhysRevD.97.063528
Phys. Rev. D **97**, no. 6, 063528 (2018)
 19. **“Exploring cosmic origins with CORE: Mitigation of systematic effects”**
P. Natoli *et al.* [CORE Collaboration].
arXiv:1707.04224 [astro-ph.CO]
DOI:10.1088/1475-7516/2018/04/022
JCAP **1804**, no. 04, 022 (2018)
 20. **“Exploring cosmic origins with CORE: Gravitational lensing of the CMB”**
A. Challinor *et al.* [CORE Collaboration].
arXiv:1707.02259 [astro-ph.CO]
DOI:10.1088/1475-7516/2018/04/018
JCAP **1804**, no. 04, 018 (2018)
 21. **“Exploring cosmic origins with CORE: Survey requirements and mission design”**
J. Delabrouille *et al.* [CORE Collaboration].
arXiv:1706.04516 [astro-ph.IM]
DOI:10.1088/1475-7516/2018/04/014
JCAP **1804**, no. 04, 014 (2018)
 22. **“Thermalized Axion Inflation”**
R. Z. Ferreira and A. Notari.
arXiv:1706.00373 [astro-ph.CO]
DOI:10.1088/1475-7516/2017/09/007
JCAP **1709**, no. 09, 007 (2017)
 23. **“Exploring cosmic origins with CORE: The instrument”**
P. de Bernardis *et al.* [CORE Collaboration].
arXiv:1705.02170 [astro-ph.IM]
DOI:10.1088/1475-7516/2018/04/015
JCAP **1804**, no. 04, 015 (2018)
 24. **“Exploring cosmic origins with CORE: effects of observer peculiar motion”**
C. Burigana *et al.* [CORE Collaboration].

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- arXiv:1704.05764 [astro-ph.CO]
DOI:10.1088/1475-7516/2018/04/021
JCAP **1804**, no. 04, 021 (2018)
25. **“Exploring cosmic origins with CORE: *B*-mode component separation”**
M. Remazeilles *et al.* [CORE Collaboration].
arXiv:1704.04501 [astro-ph.CO]
DOI:10.1088/1475-7516/2018/04/023
JCAP **1804**, no. 04, 023 (2018)
26. **“Exploring cosmic origins with CORE: Cluster science”**
J.-B. Melin *et al.* [CORE Collaboration].
arXiv:1703.10456 [astro-ph.CO]
DOI:10.1088/1475-7516/2018/04/019
JCAP **1804**, no. 04, 019 (2018)
27. **“Exploring cosmic origins with CORE: Inflation”**
F. Finelli *et al.* [CORE Collaboration].
arXiv:1612.08270 [astro-ph.CO]
DOI:10.1088/1475-7516/2018/04/016
JCAP **1804**, no. 04, 016 (2018)
28. **“Exploring cosmic origins with CORE: Cosmological parameters”**
E. Di Valentino *et al.* [CORE Collaboration].
arXiv:1612.00021 [astro-ph.CO]
DOI:10.1088/1475-7516/2018/04/017
JCAP **1804**, no. 04, 017 (2018)
29. **“Exploring cosmic origins with CORE: Extragalactic sources in cosmic microwave background maps”**
G. De Zotti *et al.* [CORE Collaboration].
arXiv:1609.07263 [astro-ph.GA]
DOI:10.1088/1475-7516/2018/04/020
JCAP **1804**, no. 04, 020 (2018)
30. **“Dissipative Axial Inflation”**
A. Notari and K. Tywoniuk.
arXiv:1608.06223 [hep-th]
DOI:10.1088/1475-7516/2016/12/038
JCAP **1612**, no. 12, 038 (2016)
31. **“Interpreting the CMB aberration and Doppler measurements: boost or intrinsic dipole?”**
O. Roldan, A. Notari and M. Quartin.
arXiv:1603.02664 [astro-ph.CO]

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- DOI:10.1088/1475-7516/2016/06/026
JCAP **1606**, no. 06, 026 (2016)
32. **“CMB all-scale blackbody distortions induced by linearizing temperature”**
A. Notari and M. Quartin.
arXiv:1510.08793 [astro-ph.CO]
DOI:10.1103/PhysRevD.94.043006
Phys. Rev. D **94**, no. 4, 043006 (2016)
33. **“Improving Planck calibration by including frequency-dependent relativistic corrections”**
M. Quartin and A. Notari.
arXiv:1504.04897 [astro-ph.IM]
DOI:10.1088/1475-7516/2015/09/050
JCAP **1509**, no. 09, 050 (2015)
34. **“On the proper kinetic quadrupole CMB removal and the quadrupole anomalies”**
A. Notari and M. Quartin.
arXiv:1504.02076 [astro-ph.CO]
DOI:10.1088/1475-7516/2015/06/047
JCAP **1506**, no. 06, 047 (2015)
35. **“On the significance of power asymmetries in Planck CMB data at all scales”**
M. Quartin and A. Notari.
arXiv:1408.5792 [astro-ph.CO]
DOI:10.1088/1475-7516/2015/01/008
JCAP **1501**, no. 01, 008 (2015)
36. **“Higgs Mass and Gravity Waves in Standard Model False Vacuum Inflation”**
A. Notari.
arXiv:1405.6943 [hep-ph]
DOI:10.1103/PhysRevD.91.063527
Phys. Rev. D **91**, 063527 (2015)
37. **“CMB Aberration and Doppler Effects as a Source of Hemispherical Asymmetries”**
A. Notari, M. Quartin and R. Catena.
arXiv:1304.3506 [astro-ph.CO]
DOI:10.1088/1475-7516/2014/03/019
JCAP **1403**, 019 (2014)
38. **“Non-Gaussianity and CMB aberration and Doppler”**
R. Catena, M. Liguori, A. Notari and A. Renzi.
arXiv:1301.3777 [astro-ph.CO]

DOI:10.1088/1475-7516/2013/09/036
JCAP **1309**, 036 (2013)

39. **“Cosmological parameter estimation: impact of CMB aberration”**
R. Catena and A. Notari.
arXiv:1210.2731 [astro-ph.CO]
DOI:10.1088/1475-7516/2013/04/028
JCAP **1304**, 028 (2013)
40. **“Inflation from the Higgs field false vacuum with hybrid potential”**
I. Masina and A. Notari.
arXiv:1204.4155 [hep-ph]
DOI:10.1088/1475-7516/2012/11/031
JCAP **1211**, 031 (2012)
41. **“Standard Model False Vacuum Inflation: Correlating the Tensor-to-Scalar Ratio to the Top Quark and Higgs Boson masses”**
I. Masina and A. Notari.
arXiv:1112.5430 [hep-ph]
DOI:10.1103/PhysRevLett.108.191302
Phys. Rev. Lett. **108**, 191302 (2012)
42. **“The Higgs mass range from Standard Model false vacuum Inflation in scalar-tensor gravity”**
I. Masina and A. Notari.
arXiv:1112.2659 [hep-ph]
DOI:10.1103/PhysRevD.85.123506
Phys. Rev. D **85**, 123506 (2012)
43. **“Measuring our Peculiar Velocity by ‘Pre-deboosting’ the CMB”**
A. Notari and M. Quartin.
arXiv:1112.1400 [astro-ph.CO]
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44. **“Observational constraints on inhomogeneous cosmological models without dark energy”**
V. Marra and A. Notari.
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DOI:10.1088/0264-9381/28/16/164004
Class. Quant. Grav. **28**, 164004 (2011)
45. **“Measuring our peculiar velocity on the CMB with high-multipole off-diagonal correlations”**
L. Amendola, R. Catena, I. Masina, A. Notari, M. Quartin and C. Quercellini.
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- DOI:10.1088/1475-7516/2011/07/027
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46. **“Testing the Void against Cosmological data: fitting CMB, BAO, SN and H0”**
T. Biswas, A. Notari and W. Valkenburg.
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DOI:10.1088/1475-7516/2010/11/030
JCAP **1011**, 030 (2010)
47. **“Detecting the Cold Spot as a Void with the Non-Diagonal Two-Point Function”**
I. Masina and A. Notari.
arXiv:1007.0204 [astro-ph.CO]
DOI:10.1088/1475-7516/2010/09/028
JCAP **1009**, 028 (2010)
48. **“The Cold Spot as a Large Void: Lensing Effect on CMB Two and Three Point Correlation Functions”**
I. Masina and A. Notari.
arXiv:0905.1073 [astro-ph.CO]
DOI:10.1088/1475-7516/2009/07/035
JCAP **0907**, 035 (2009)
49. **“The Cold Spot as a Large Void: Rees-Sciama effect on CMB Power Spectrum and Bispectrum”**
I. Masina and A. Notari.
arXiv:0808.1811 [astro-ph]
DOI:10.1088/1475-7516/2009/02/019
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50. **“Local Void vs Dark Energy: Confrontation with WMAP and Type Ia Supernovae”**
S. Alexander, T. Biswas, A. Notari and D. Vaid.
arXiv:0712.0370 [astro-ph]
DOI:10.1088/1475-7516/2009/09/025
JCAP **0909**, 025 (2009)
51. **“Swiss-Cheese Inhomogeneous Cosmology and the Dark Energy Problem”**
T. Biswas and A. Notari.
astro-ph/0702555
DOI:10.1088/1475-7516/2008/06/021
JCAP **0806**, 021 (2008)
52. **“Nonlinear Structure Formation and Apparent Acceleration: An Investigation”**
T. Biswas, R. Mansouri and A. Notari.

astro-ph/0606703
DOI:10.1088/1475-7516/2007/12/017
JCAP **0712**, 017 (2007)

53. **“Can inflation solve the hierarchy problem?”**

T. Biswas and A. Notari.
hep-ph/0511207
DOI:10.1103/PhysRevD.74.043508
Phys. Rev. D **74**, 043508 (2006)

54. **“Graceful old inflation”**

F. Di Marco and A. Notari.
astro-ph/0511396
DOI:10.1103/PhysRevD.73.063514
Phys. Rev. D **73**, 063514 (2006)

55. **“Late time failure of Friedmann equation”**

A. Notari.
astro-ph/0503715
DOI:10.1142/S0217732306021852
Mod. Phys. Lett. A **21**, 2997 (2006)

56. **“Large-scale magnetic fields from density perturbations”**

S. Matarrese, S. Mollerach, A. Notari and A. Riotto.
astro-ph/0410687
DOI:10.1103/PhysRevD.71.043502
Phys. Rev. D **71**, 043502 (2005)
DFPD-04-A-25

57. **“Cosmological influence of super-Hubble perturbations”**

E. W. Kolb, S. Matarrese, A. Notari and A. Riotto.
astro-ph/0410541
DOI:10.1142/S0217732305018682
Mod. Phys. Lett. A **20**, 2705 (2005)
FERMILAB-PUB-04-283-A

58. **“The Effect of inhomogeneities on the expansion rate of the universe”**

E. W. Kolb, S. Matarrese, A. Notari and A. Riotto.
hep-ph/0409038
DOI:10.1103/PhysRevD.71.023524
Phys. Rev. D **71**, 023524 (2005)
FERMILAB-PUB-04-145-A

59. **“Constraints on neutrino masses from leptogenesis models”**

T. Hambye, Y. Lin, A. Notari, M. Papucci and A. Strumia.
hep-ph/0312203

DOI:10.1016/j.nuclphysb.2004.06.027
Nucl. Phys. B **695**, 169 (2004)
IFUP-TH-2003-48

60. **“Towards a complete theory of thermal leptogenesis in the SM and MSSM”**

G. F. Giudice, A. Notari, M. Raidal, A. Riotto and A. Strumia.
hep-ph/0310123
DOI:10.1016/j.nuclphysb.2004.02.019
Nucl. Phys. B **685**, 89 (2004)
IFUP-TH-2003-37, CERN-TH-2003-240

61. **“On the reheating stage after inflation”**

E. W. Kolb, A. Notari and A. Riotto.
hep-ph/0307241
DOI:10.1103/PhysRevD.68.123505
Phys. Rev. D **68**, 123505 (2003)
FERMILAB-PUB-03-212-A

62. **“Minimal theoretical uncertainties in inflationary predictions”**

D. J. H. Chung, A. Notari and A. Riotto.
hep-ph/0305074
DOI:10.1088/1475-7516/2003/10/012
JCAP **0310**, 012 (2003)
CERN-TH-2003-105

63. **“The Curvaton as a pseudoNambu-Goldstone boson”**

K. Dimopoulos, D. H. Lyth, A. Notari and A. Riotto.
hep-ph/0304050
DOI:10.1088/1126-6708/2003/07/053
JHEP **0307**, 053 (2003)
DFPD-TH-03-12

64. **“Isocurvature perturbations in the ekpyrotic universe”**

A. Notari and A. Riotto.
hep-th/0205019
DOI:10.1016/S0550-3213(02)00765-4
Nucl. Phys. B **644**, 371 (2002)
DFPD-02-TH-08

Curriculum Vitae

Carlo Pagani

INFORMAZIONI PERSONALI

Nome e Cognome	Carlo Pagani
Indirizzo	OMISSIS
Telefono	
E-mail	
Nazionalità	Italiana
Data di nascita	omissis

POSIZIONI IN AMBITO ACCADEMICO

2021 – oggi	Institut für Physik, Johannes-Gutenberg-Universität, Mainz (Germania) Postdoc (gruppo del Prof. Martin Reuter)
2019 – 2021	Centre national de la recherche scientifique (CNRS – LPMMC), Université Grenoble Alpes, Grenoble (Francia) Postdoc (gruppo della Prof.ssa Léonie Canet)
2015 – 2019	Institut für Physik, Johannes-Gutenberg-Universität, Mainz (Germania) Postdoc (gruppo del Prof. Martin Reuter)
2014 – 2015	Institut für Physik, Johannes-Gutenberg-Universität, Mainz (Germany) Postdoc (Blanceflor Fellowship, gruppo del Prof. Martin Reuter)

ISTRUZIONE E FORMAZIONE

2010 – 2014	SISSA, Scuola Internazionale Superiore di Studi Avanzati, Trieste (Italia) Dottorato di Ricerca in Fisica (cum laude)
Supervisore	Prof. Roberto Percacci, SISSA
Titolo di Tesi	<i>“Applications of the functional renormalization group in curved spacetime”</i>
2008 – 2010	Università di Trieste – Dipartimento di Fisica, Trieste (Italia) Laurea Magistrale in Fisica, curriculum di Fisica Teorica (110/110 e lode)
Supervisore	Prof. Ennio Gozzi, Università di Trieste – Dipartimento di Fisica Teorica
Titolo di Tesi	<i>“Superfields and local invariances in classical mechanics”</i>

2005 – 2008	Università di Trieste – Dipartimento di Fisica, Trieste (Italia)
	Laurea Triennale in Fisica (110/110 e lode)
Supervisore	Prof. Ennio Gozzi, Università di Trieste – Dipartimento di Fisica Teorica
Titolo di Tesi	<i>“Introduzione ai gruppi di Lie e gruppo di Lorentz”</i>

INTERESSI SCIENTIFICI

I miei interessi scientifici riguardano:

- la gravità quantistica e il gruppo di rinormalizzazione (scenario di sicurezza asintotica);
- i sistemi fuori equilibrio (con particolare attenzione ai fenomeni turbolenti);
- gli aspetti formali e le applicazioni del gruppo di rinormalizzazione funzionale (FRG).

Di seguito descrivo i miei contributi in questi campi (i lavori citati fanno riferimento all’elenco che si trova nella sezione “Pubblicazioni Scientifiche”).

GRAVITÀ QUANTISTICA E IL GRUPPO DI RINORMALIZZAZIONE

Nel 1979 Weinberg propose uno scenario in cui la gravità è non perturbativamente rinormalizzabile grazie ad un punto fisso UV attrattivo non-Gaussiano (tale situazione fu battezzata “sicurezza asintotica”). La presenza di un tale punto fisso per la gravità fu notata in dimensione $d = 2 + \epsilon$. Questo scenario per la gravità quantistica venne ripreso più recentemente quando un’equazione RG non-perturbativa per la gravità venne proposta (Reuter 1996).

La mia attività in questo campo concerne diversi aspetti. Durante il dottorato, sotto la supervisione di Roberto Percacci, ho lavorato sulla dimensione anomala del gravitone [3] e sulla presenza di punti fissi per teorie dove l’invarianza di Weyl è preservata grazie ad un dilatone o ad un vettore [2,6]. Durante il mio postdoc a Mainz, ho continuato a sviluppare la mia ricerca nel campo della gravità quantistica studiando la rinormalizzazione di torsione e non-metricità [9], l’entanglement entropy [15] e l’indipendenza dal background [19,22]. Inoltre, ho iniziato a studiare alcuni operatori geometrici, come la lunghezza geodetica, al fine di poter confrontare le previsioni della sicurezza asintotica con altri scenari per la gravità quantistica [11,17,18,20].

SISTEMI FUORI EQUILIBRIO E TURBOLENZA

Dopo aver concluso il dottorato, ho iniziato a lavorare all’applicazione di alcuni metodi della teoria dei campi ai sistemi fuori equilibrio, con particolare attenzione ai fenomeni turbolenti.

Una delle sfide teoriche più importanti in turbolenza è la predizione dello scaling anomalo delle correlazioni di differenze di velocità a tempi uguali, i.e., $\langle[(\vec{v}(t, x) - \vec{v}(t, 0)) \cdot \vec{x} / \|\vec{x}\|^n]\rangle$, dette funzioni di struttura. Nell’ambito del formalismo FRG ho sviluppato delle tecniche per studiare questi fenomeni considerando un semplice modello di trasporto turbolento [8]. Ho iniziato inoltre una collaborazione con la prof.ssa Léonie Canet (Univ. di Grenoble, Francia) per lo studio delle proprietà temporali e di scaling in sistemi turbolenti, come i fluidi 2D e i campi scalari trasportati [16,24,25]. Da un punto di vista più formale, ho studiato la relazione fra la teoria dei campi fuori equilibrio (formalismo di Schwinger-Keldysh) e la formulazione a path integral della meccanica quantistica à la Moyal, considerando anche le recenti super estensioni [12,23]. Ho inoltre studiato l’applicazione del path integral alla meccanica classica [1,L1].

ASPETTI FORMALI E APPLICAZIONI DEL GRUPPO DI RINORMALIZZAZIONE NON PERTURBATIVO

Il programma Wilsoniano di rinormalizzazione può essere implementato in teoria dei campi direttamente a vari funzionali quali l’azione (Wilson, Kogut 1974; Polchinski 1984) e l’azione effettiva (Wetterich 1993). La dipendenza di questi funzionali dal cutoff è determinata da equazioni funzionali esatte. L’applicazione pratica di tali equazioni richiede l’utilizzo di schemi di approssimazione.

Mi sono interessato a diversi aspetti formali riguardanti il gruppo di rinormalizzazione funzionale (FRG). Durante il dottorato ho studiato la relazione del FRG con la funzione c di Zamolodchikov [5] e il gruppo di rinormalizzazione locale [7]. In seguito ho iniziato a studiare gli operatori composti nel formalismo FRG [10]. In quest’ottica, ho iniziato una collaborazione con il prof. Hidenori Sonoda (Univ. di Kobe, Giappone) per lo studio dell’“operator product expansion” (OPE) mediante il FRG,

utilizzando sia gli operatori composti [13,21] che un approccio geometrico allo spazio delle teorie [14]. Le tecniche introdotte hanno permesso di sviluppare e testare degli schemi di approssimazione non perturbativi per il calcolo dei coefficienti OPE via FRG [26].

QUALIFICHE E FINANZIAMENTI

ABILITAZIONE	Abilitazione Scientifica Nazionale a professore di seconda fascia per il settore concorsuale FIS-02/A2 (2021–2030).
FINANZIAMENTI	“Non-perturbative approximation schemes for the operator product expansion via the functional renormalization group” DFG grant PA 3040/3-1 (2018/2019).
BORSE DI STUDIO	- borsa di studio “Blanceflor” (2014/2015). - borsa di studio “Luciano Fonda” (2008/2009; 2009/2010).
RICONOSCIMENTI	“Seal of excellence” per il progetto “Renormalization group approach to scalar turbulence” quale progetto di alta qualità per una Marie Curie action (MSCA – 2019).

PUBBLICAZIONI SCIENTIFICHE

ARTICOLI

26. F. Rose, C. Pagani, e N. Dupuis,
“Operator product expansion coefficients from the nonperturbative functional renormalization group”,
Phys.Rev.D 105 (2022) 065020, [arXiv:2110.13174](#).
25. A. Gorbunova, C. Pagani, G. Balarac, L. Canet, V. Rossetto,
“Eulerian spatio-temporal correlations in passive scalar turbulence”,
Phys. Rev. Fluids 6 (2021) 124606, [arXiv:2104.12453](#).
24. C. Pagani e L. Canet,
“Spatio-temporal correlation functions in scalar turbulence from functional renormalization group”,
Phys. Fluids 33 (2021) 065109, [arXiv:2103.07326](#).
23. E. Gozzi, C. Pagani e M. Reuter,
“The Response Field and the Saddle Points of Quantum Mechanical Path Integrals”,
Annals of Physics 429 (2021) 168457, [arXiv:2004.08874](#).
22. C. Pagani e M. Reuter,
“Why the Cosmological Constant Seems to Hardly Care About Quantum Vacuum Fluctuations: Surprises From Background Independent Coarse Graining”,
Front. in Phys. 8 (2020) 214.
21. C. Pagani e H. Sonoda,
“Operator product expansion coefficients in the exact renormalization group formalism”,
Phys.Rev.D 101 (2020) 10, [arXiv:2001.07015](#).
20. M. Becker, C. Pagani e O. Zanusso,
“Fractal geometry of higher derivative gravity”,
Phys.Rev.Lett. 124 (2020) 15, 151302, [arXiv:1911.02415](#).
19. C. Pagani e M. Reuter,
“Background Independent Quantum Field Theory and Gravitating Vacuum Fluctuations”,
Annals Phys. 411 (2019) 167972, [arXiv:1906.02507](#).

18. M. Becker e C. Pagani,
“*Geometric operators in the Einstein-Hilbert truncation*”,
Universe 5 (2019) 75.
17. M. Becker e C. Pagani,
“*Geometric operators in the asymptotic safety scenario for quantum gravity*”,
Phys. Rev. D 99 (2019) 066002, [arXiv:1810.11816](#).
16. M. Tarpin, L. Canet, C. Pagani e N. Wschebor,
“*Stationary, isotropic and homogeneous two-dimensional turbulence: a first non-perturbative renormalization group approach*”,
J. Phys. A 52 (2019) 085501, [arXiv:1809.00909](#).
15. C. Pagani e M. Reuter,
“*Finite Entanglement Entropy in Asymptotically Safe Quantum Gravity*”,
JHEP 1807 (2018) 039, [arXiv:1804.02162](#).
14. C. Pagani e H. Sonoda,
“*Geometry of the theory space in the exact renormalization group formalism*”,
Phys. Rev. D 97 (2018) 025015, [arXiv:1710.10409](#).
13. C. Pagani e H. Sonoda,
“*Products of composite operators in the exact renormalization group formalism*”,
PTEP 2018, 023B02 (2018), [arXiv:1707.09138](#).
12. C. Pagani,
“*Note on the super-extended Moyal formalism and its BBGKY hierarchy*”,
Annals Phys. 385 (2017) 695, [arXiv:1705.06964](#).
11. C. Pagani e M. Reuter,
“*Composite operators in Asymptotic Safety*”,
Phys. Rev. D 95 (2017) 066002, [arXiv:1611.06522](#).
10. C. Pagani,
“*Note on scaling arguments in the effective average action formalism*”,
Phys. Rev. D 94 (2016) 045001, [arXiv:1603.07250](#).
9. C. Pagani e R. Percacci,
“*Quantum gravity with torsion and non-metricity*”,
Class. Quant. Grav. 32 (2015) 195019, [arXiv:1506.02882](#).
8. C. Pagani,
“*Functional Renormalization Group approach to the Kraichnan model*”,
Phys. Rev. E 92 (2015) 033016, Add.: Phys. Rev. E 97 (2018) 049902, [arXiv:1505.01293](#).
7. A. Codello, G. D’Odorico e C. Pagani,
“*Functional and Local Renormalization Groups*”,
Phys. Rev. D 91 (2015) 125016, [arXiv:1502.02439](#).
6. C. Pagani e R. Percacci,
“*Quantization and fixed points of non-integrable Weyl theory*”,
Class. Quant. Grav. 31 (2014) 115005, [arXiv:1312.7767](#).
5. A. Codello, G. D’Odorico e C. Pagani,
“*A functional RG equation for the c-function*”,
JHEP 40 (2014) 1407, [arXiv:1312.7097](#).
4. E. Cattaruzza, E. Gozzi e C. Pagani,
“*Entanglement, Superselection Rules and Supersymmetric Quantum Mechanics*”,
Phys. Lett. A 378 (2014) 2501, [arXiv:1308.6212](#).

3. A. Codello, G. D’Odorico e C. Pagani,
“Consistent closure of renormalization group flow equations in quantum gravity”,
 Phys. Rev. D(R) 89 (2014) 081701, [arXiv:1304.4777](#).
2. A. Codello, G. D’Odorico, C. Pagani e R. Percacci,
“The Renormalization Group and Weyl-invariance”,
 Class. Quant. Grav. 30 (2013) 115015, [arXiv:1210.3284](#).
1. E. Gozzi e C. Pagani,
“Universal local symmetries and non-superposition in classical mechanics”,
 Phys. Rev. Lett. 105 (2010) 150604, [arXiv:1006.3029](#).

ATTI DI CONVEGNI

- C1. G. D’Odorico, A. Codello e C. Pagani,
“The Background Effective Average Action Approach to Quantum Gravity”,
 in the proceedings of the “1st Karl Schwarzschild Meeting on Gravitational Physics”, [Springer Proc. Phys. 170 \(2016\) 233](#).

LIBRI

- L1. E. Gozzi, E. Cattaruzza e C. Pagani,
“Path Integrals for Pedestrians”,
[World Scientific Publishing, Singapore \(2016\)](#).

L’elenco aggiornato delle pubblicazioni è disponibile al link: <https://inspirehep.net/authors/1301159>.

SITO WEB PERSONALE

Una versione aggiornata del CV e delle pubblicazioni può essere trovata sul mio sito

<https://sites.google.com/view/carlopagani/>

SEMINARI E CONFERENZE

INTERVENTI SU INVITO

- “OPE coefficients from FRG”, Seminario a LPTMC – Sorbonne Université, 11 febbraio 2020, Parigi, Francia.
- “Functional renormalization group approach to 2D turbulence”, conferenza: FRGIM - Functional and Renormalization-Group methods, 16–20 settembre 2019, Trento, Italia.
- “Geometry of the theory space and the functional renormalization group”, conferenza: Gravity and Other Fields under the Volcano, 10–12 giugno 2019, Catania, Italia.
- “Scalar turbulence, anomalous scaling, and the functional renormalization group”, Seminario a Kobe University, 24 aprile 2019, Kobe, Giappone.
- “Geometric operators in Asymptotic Safety”, Workshop: Quantum Fields – from Fundamental Concepts to Phenomenological Questions, 26–28 settembre 2018, Mainz, Germania.
- “Entanglement entropy in Asymptotic Safety”, conferenza: ERG 2018, 09–13 luglio 2018, Parigi, Francia.
- “Scaling of geometric operators in Asymptotic Safety”, Workshop: Quantum spacetime and the renormalization group, 18–22 giugno 2018, Bad Honnef, Germania.
- “Intermittency in the Kraichnan model from a functional renormalization group perspective”, Workshop: Turbulence et polaritons, 7 giugno 2017, Grenoble, Francia.
- “Composite operators in Asymptotic Safety”, Workshop: Quantum spacetime and the renormalization group, 13–17 febbraio 2017, Leiden, Paesi Bassi.

- “Functional renormalization group and composite operators, some concepts and applications”, Seminario all’Università di Jena, 19 ottobre 2017, Jena, Germania.
- “Composite operators in Asymptotic Safety”, Seminario a Radboud University, 9 dicembre 2016, Nijmegen, Paesi Bassi.
- “Anomalous scaling in a simple model of scalar turbulence”, Seminario all’Università di Heidelberg, 23 novembre 2016, Heidelberg, Germania.

ULTERIORI INTERVENTI

- “Operator product expansion and the functional renormalization group”, seminario online: Mainz-Nijmegen meeting, 4 dicembre 2021.
- “Functional renormalization group approach to spatiotemporal correlation functions of passively advected scalar fields”, seminario online: John Hopkins/Lyon working seminar, 16 Aprile 2021.
- “Functional renormalization group approach to scalar turbulence”, conferenza online: ERG 2020, 2–6 novembre 2020.
- “Functional renormalization group approach to spatiotemporal correlation functions of passively advected scalar fields”, seminario online: John Hopkins/Lyon working seminar, 4 giugno 2020.
- “Scalar turbulence, anomalous scaling, and FRG”, seminario al LPMMC, 22 gennaio 2020, Grenoble, Francia.
- “Quantum gravity with torsion and non-metricity”, seminario online: Asymptotic Safety, 29 maggio 2015.
- “The functional RG and the c -function”, First FLAG meeting: The Quantum and the Gravity, 28–30 maggio 2014, Bologna, Italia.
- “The functional RG and the c -function”, seminario all’Università di Heidelberg, 11 dicembre 2013, Heidelberg, Germania.
- “The functional RG and the c -function”, seminario all’Università di Mainz, 9 dicembre 2013, Mainz, Germania.
- “Consistent closure of RG flow equations in quantum gravity”, conferenza: 2nd Mediterranean Conference on Classical and Quantum Gravity (2nd MCCQG), 9–15 giugno 2013, Veli Lošinj, Croazia.

ULTERIORI CONFERENZE E WORKSHOP

- Workshop: Turbulence: reunion of GdR, 21–23 ottobre 2019, Lione, Francia.
- Workshop: 3rd FLAG meeting: the Quantum and the Gravity, 13–14 giugno 2019, Catania, Italia.
- Workshop: Turbulent cascades II, 5–7 dicembre 2017, Lione, France.
- Conferenza: ERG 2016, 19–23 settembre 2016, Trieste, Italia.
Poster “Functional Renormalization Group approach to the Kraichnan model”.
- Workshop: NEQFLUIDS2016 – Classical and Quantum Fluids Out of Equilibrium, 13–16 luglio 2016, Grenoble, Francia.
Poster “Functional renormalization group approach to the Kraichnan model”.
- Workshop: Strongly-Interacting Field Theories, 5–7 novembre 2015, Jena, Germania.
Poster “Functional and local renormalization groups”.
- Conferenza: ERG 2014, 22–26 settembre 2014, Lefkada, Grecia.
Poster “Quantum gravity with torsion and non-metricity”.
- Workshop: Renormalization group approaches quantum gravity, 22–25 aprile 2014, Perimeter Institute, Waterloo, Ontario, Canada.
- Conferenza: ERG 2012, 3–7 settembre 2012, Aussois, Francia.
Poster: “Weyl invariance and the functional RG”.

ATTIVITÀ ACCADEMICA

INSEGNAMENTO	Insegnante del corso “Theoretical elementary particle physics”, aprile 2022 – luglio 2022, Università di Mainz.
ASSISTENTE	- “Energetique” (meccanica newtoniana, fluidi e laboratorio) tenuto dal Prof. Denis Roux, settembre 2020 – gennaio 2021, Université Grenoble Alpes. - “Quantization via functional integral II” tenuto dal Prof. Martin Reuter, ottobre 2017 – febbraio 2018, Università di Mainz. - “Quantization via functional integral I” tenuto dal Prof. Martin Reuter, maggio – luglio 2017, Università di Mainz.
SECONDO SUPERVISORE	- Frederik Stoel, titolo di Tesi Triennale: “Calculating the critical exponent ν in the 3D Ising model” (2017). Supervisore: Prof. F. Saueressig, Radboud University, Nijmegen, Paesi Bassi. - Maximilian Becker, studente di dottorato del prof. M. Reuter, in qualità di mentore (2017–2019), Università di Mainz.
REFeree	Referee per le riviste: Phys. Rev. Lett., Phys. Rev. A, Phys. Rev. D, Nucl. Phys. B, Mod. Phys. Lett. A, Universe, Frontiers in Physics.
HOST PER VISITATORI	- Prof. H. Sonoda, 3 – 13 settembre 2019 all’Università di Mainz, Germania. - F. Stoel, 17 – 21 aprile 2017 all’Università di Mainz, Germania.
INCARICHI ORGANIZZATIVI	Organizzatore della serie “PhD and Postdoc seminars” al LPMMC, CNRS, Grenoble (da marzo 2020 a luglio 2021).
PERIODI DI VISITA	- Gruppo del Prof. H. Sonoda, 3 aprile – 18 maggio 2019, Kobe, Giappone. - Gruppo della Prof.ssa L. Canet, 3 – 8 dicembre 2017, Grenoble, Francia. - Gruppo della Prof.ssa L. Canet, 5 – 17 giugno 2017, Grenoble, Francia.

COMPETENZE PERSONALI

MADRELINGUA	Italiano
ALTRE LINGUE	Inglese (fluente), Tedesco (base), Francese (base)
COMPETENZE INFORMATICHE	Ottima conoscenza del programma Mathematica e dei relativi pacchetti. Buona conoscenza dei linguaggi di programmazione Fortran, Python e C.

19 aprile 2022,

Il sottoscritto

CURRICULUM VITAE

Personal information

Name: Alessandro
Surname: Pini
Nationality: Italian
Date of birth: OMISSIS
Place of birth: --
Telephone number: --
Address: --
e-mail address: --
e-mail (PEC): --

Work Experience

- **Post-doctoral researcher**
22 September 2020 - present,
INFN-Sezione di Torino, Via Pietro Giuria 1, 10125 Torino, Italy.
- **Post-doctoral researcher**
01 October 2017 - 31 August 2020,
DESY Theory Group, Notkestrasse 85, 22607 Hamburg, Germany.

Education

- **Ph.D. in theoretical physics**
September 2013 - September 2017, Universidad de Oviedo (Spain).
 - Thesis title: “*Gauge theories in five and lower dimension. Holography and exact results*”. Ph.D. advisor Dr. Diego Rodríguez-Gómez.
- **Master in Theoretical Physics**
November 2010 - July 2013, Università degli Studi di Milano-Bicocca.
 - final mark: 110/110 cum laude.

- Master Thesis title “*Application of the AdS/CFT correspondence to non relativistic theories*”, supervisor Prof. A. Zaffaroni, co-supervisor Dr. Alessandro Tomasiello.

- **Bachelor in Physics**

October 2007 - September 2010, Università degli Studi di Milano-Bicocca.

- final mark: 110/110 cum laude.
- Title of the bachelor final project : “*Effetto tunnel nel formalismo dell’integrale funzionale: teoria ed esempi*”, supervisor Dr. A. Tomasiello.

Research Interests

SCFTs in different number of dimensions, String Theory, AdS/CFT correspondence

Fellowship and grants

10/2014 - 09/2017 Severo Ochoa Ph.D. Fellowship FICYT grant BP14-003.
03/2015 - 05/2015 Support of the COST Action MP1210 STSM.

Organization

Co-organizer of the “ *V Postgraduate Meeting On Theoretical Physics*”, Oviedo 17-18 November 2016.

Languages

Italian (native), English (full professional proficiency), Spanish (professional proficiency).

List of Scientific Publications

1. A. Pini and D. Rodriguez-Gomez, “*Gauge/gravity duality and RG flows in 5d gauge theories*,” Nucl. Phys. B **884** (2014) 612 [arXiv:1402.6155 [hep-th]].
2. A. Pini and D. Rodriguez-Gomez, “Aspects of the moduli space of instantons on $\mathbb{CP}^2$ and its orbifolds,” Phys. Rev. D **93** (2016) [arXiv:1502.07876 [hep-th]].
3. A. Pini, D. Rodriguez-Gomez and J. Schmude, “*Rigid Supersymmetry from Conformal Supergravity in Five Dimensions*,” JHEP **1509**, 118 (2015) [arXiv:1504.04340 [hep-th]].
4. C. Papageorgakis, A. Pini and D. Rodriguez-Gomez, “*Nekrasov-Shatashvili limit of the 5D superconformal index*,” Phys. Rev. D **94**, no. 4, 045007 (2016)
5. A. Pini, D. Rodriguez-Gomez and J. G. Russo, “Large N correlation functions $\mathcal{N} = 2$ superconformal quivers,” JHEP **1708** (2017) 066, [arXiv:1701.02315 [hep-th]].
6. A. Bourget and A. Pini, “*Non-Connected Gauge Groups and the Plethystic Program*,” JHEP **1710** (2017) 033 arXiv:1706.03781 [hep-th].
7. A. Hanany and A. Pini, “*HWG for Coulomb branch of 3d Sicilian theory mirrors*,” arXiv:1707.09784 [hep-th].
8. A. Bourget, A. Pini and D. Rodriguez-Gomez, “*Towards Deconstruction of the Type D (2,0) Theory*,” JHEP **1712**, 146 (2017).
9. A. Bourget, A. Pini and D. Rodriguez-Gomez, “*Gauge theories from principally extended disconnected gauge groups*,” Nucl. Phys. B **940** (2019) 351 [arXiv:1804.01108 [hep-th]].
10. T. Bourton, A. Pini and E. Pomoni, “4d $\mathcal{N} = 3$ indices via discrete gauging,” JHEP **1810** (2018) 131 [arXiv:1804.05396 [hep-th]].
11. G. Arias-Tamargo, A. Bourget, A. Pini and D. Rodriguez-Gomez, “*Discrete gauge theories of charge conjugation*,” Nucl. Phys. B **946** (2019) 114721 arXiv:1903.06662 [hep-th].

12. V. Niarchos, C. Papageorgakis, A. Pini and E. Pomoni, “(Mis-)Matching Type-B Anomalies on the Higgs Branch,” JHEP **01** (2021), 106 [arXiv:2009.08375 [hep-th]].
13. T. Bourton, A. Pini and E. Pomoni, “The Coulomb and Higgs branches of $\mathcal{N} = 1$ theories of Class $\mathcal{S}_k$,” JHEP **02** (2021), 137 [arXiv:2011.01587 [hep-th]].
14. G. Arias-Tamargo, A. Bourget and A. Pini, “Discrete gauging and Hasse diagrams,” SciPost Phys. **11** (2021) no.2, 026 [arXiv:2105.08755 [hep-th]].
15. M. Beccaria, M. Billò, M. Frau, A. Lerda and A. Pini, “Exact results in a $\mathcal{N} = 2$ superconformal gauge theory at strong coupling,” JHEP **07** (2021), [arXiv:2105.15113 [hep-th]].
16. M. Billo, M. Frau, F. Galvagno, A. Lerda and A. Pini, “Strong-coupling results for $\mathcal{N} = 2$ superconformal quivers and holography,” JHEP **10** (2021), 161 [arXiv:2109.00559 [hep-th]].
17. M. Billo, M. Frau, A. Lerda, A. Pini and P. Vallarino, “Three-point functions in a $\mathcal{N} = 2$ superconformal gauge theory and their strong-coupling limit,” [arXiv:2202.06990 [hep-th]].

Attendance in Workshops and conferences

10/2013	<i>"II Postgraduate Meeting on Theoretical Physics"</i> , Instituto de Fisica Teorica-UAM/CSIC, Madrid, Spain.
01/2014	<i>"Iberian Strings 2014 Workshop"</i> , Palencia, Spain.
04/2014	<i>"Spring School on Superstring Theory and Related Topics"</i> , International Center for Theoretical Physics, Trieste, Italy.
05/2014	<i>"Gauge theory, Supergravity and Superstrings"</i> , Palencia, Spain.
11/2014	<i>"III Postgraduate Meeting on Theoretical Physics"</i> , Faculdade de Fisica-Universidade de Santiago de Compostela, Santiago de Compostela, Spain.
12/2014	<i>"LACES 2014: Lezioni Avanzate di Campi E Stringhe"</i> , Istituto di Fisica Teorica Galileo Galilei, Arcetri, Italy.
11/2015	<i>"IV Postgraduate Meeting on Theoretical Physics"</i> , Instituto de Fisica Teorica-UAM/CSIC, Madrid, Spain.
12/2015	<i>"LACES 2015: Lezioni Avanzate di Campi E Stringhe"</i> , Instituto de Fisica Teorica Galileo Galilei, Arcetri, Italy.
12/2015	<i>"XI AVOGADRO MEETING on Strings, Supergravity and Gauge Theories"</i> , Bologna University, Bologna, Italy.
01/2016	<i>"Strings, Cosmology and Gravity Student Conference 2016"</i> , Imperial College London, London (UK).
01/2016	<i>"Iberian Strings 2016 Workshop"</i> , Instituto de Fisica Teorica-UAM/CSIC, Madrid, Spain.
06/2016	<i>"Cargèse summer school 2016"</i> Institut d'Etudes Scientifiques de Cargèse, Cargèse, France.
11/2016	<i>"V Postgraduate Meeting on Theoretical Physics"</i> Oviedo, Spain.
07/2017	<i>"2017 Simons Summer Workshop"</i> Simons Center for Geometry and Physics, Stony Brook, NY, USA.
12/2017	<i>"XIII AVOGADRO MEETING on Strings, Supergravity and Gauge Theories"</i> , Padova University, Padova, Italy.

- 07/2018 *“Supersymmetric theories, dualities and deformations”*, Albert Einstein Center Institute for Theoretical Physics Bern (Switzerland).
- 07/2018 *“2018 IHES Summer School: Supersymmetric localization and exact results”*, Institut des Hautes Études Scientifiques, Paris, France.
- 09/2018 *“DESY Theory Workshop”*, DESY Hamburg, Germany.
- 12/2018 *“XIV Avogadro Meeting String Supergravity and Gauge Theories”*, Tor-Vergata University-Rome, Italy.
- 09/2019 *“DESY Theory Workshop”*, DESY Hamburg, Germany.
- 02/2020 *“Young Researchers Integrability School 2020 ”*, DESY Hamburg, Germany.
- 06/2021 *“Cortona Young 2021”*, Galileo Galilei Institute (online event).
- 07/2021 *“Integrability in Gauge and String Theory 2021”*, Torino, Italy.
- 03/2022 *“Iberian Strings 2022”*, Gijón, Spain.

Seminars and Workshops talks

- 11/2014 *“Gauge/gravity duality and RG flows in QFT,”* IMPF 2014, Santiago de Compostela (Spain).
- 01/2015 *“Gauge/gravity duality and RG flows in 5d gauge theories,”* University of Milano-Bicocca, Milano (Italy).
- 11/2015 *“Hilbert Series and Gauge Invariants,”* IV Postgraduate Meeting On Theoretical Physics, Madrid IFT (Spain).
- 01/2016 *“Aspects of the moduli space of instantons on $\mathbb{CP}^2$ ”* Strings, Cosmology and Gravity Student Conference 2016, Imperial College London, London.
- 01/2016 *“Hilbert Series and Gauge Invariants,”* Iberian Strings 2016 Workshops (gong-show), Madrid IFT (Spain).
- 07/2018 *“4d $\mathcal{N} = 3$ indices via discrete gauging”*, “Supersymmetric theories, dualities and deformations”, Albert Einstein Center Institute for Theoretical Physics Bern (Switzerland).
- 07/2018 *“4d $\mathcal{N} = 3$ indices via discrete gauging”*, 2018 IHES Summer School: Supersymmetric localization and exact results”, Institut des Hautes Études Scientifiques, Paris (France).
- 09/2018 *“4d $\mathcal{N} = 3$ indices via discrete gauging”*, “DESY Theory Workshop”, DESY Hamburg, Germany.
- 12/2018 *“Discrete Gaugings and Anomalies”*, XIV Avogadro Meeting, Rome Italy.
- 11/2020 *“Type B anomalies (Mis-)Matching”*, Università di Torino, Italy.
- 03/2022 *“Exact results in a $\mathcal{N} = 2$ SCFT at strong coupling”*, Iberian Strings 2022, Gijón, Spain.

Scientific visits

I visited the following research centers:

- 01/03/2015 - 30/04/2015, String theory group of the Queen Mary University London.
- 01/05/2015 - 01/06/2015, Theoretical Physics Group of the Imperial College London.
- 29/10/2018 - 05/11/2018, Techion String Theory Group at Haifa (Israel).

Teaching experience

- *Spring term 2016* Tutor, *Quantum mechanics* (Bachelor course) by Prof. Ferrero Melgar and by Prof. Patrick Meessen. Oviedo University (Spain).
- *Spring term 2017* Tutor, *Quantum mechanics* (Bachelor course) by Prof. Ferrero Melgar and by Prof. Patrick Meessen. Oviedo University (Spain).

Extracurricular activities and Volunteering

Volunteering at the Italian Red Cross (*November 2010- August 2013*).

Sport activities: running and hiking.

Professional References:

- Dr. Diego Rodríguez-Gómez (Ph.D. Advisor)
Departamento de Física
Oviedo University
Calle Federico García Lorca 18, 33007 Oviedo, Spain
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- Dr. Elli Pomoni
DESY Theory Group,
Notkestraße 85,
22607 Hamburg, Germany
elli.pomoni@desy.de
- Dr. Costis Papageorgakis
School of Physics and Astronomy
Queen Mary, University of London
327 Mile End Road, London, E1 4NS, UK
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CURRICULUM VITAE

Lorenzo Sebastiani
OMISSIS

FORMAZIONE

- dicembre 2011:
Dottorato in Fisica, Università di Trento
Titolo della tesi: *“General aspects of modified theories of gravity”*
Supervisore: Prof. S. Zerbini;
- febbraio 2008:
Laurea Specialistica in Fisica, Università di Trento
Titolo della tesi: *“Un modello di gravità modificata per l’inflazione e la corrente accelerazione cosmica”*
Supervisore: Prof. S. Zerbini;
- ottobre 2005:
Laurea triennale in Fisica, Università di Trento
Titolo della tesi: *“L’equazione di Dirac”*
Supervisore: Prof. L. Vanzo;
- luglio 2001:
Diploma di maturità classica presso il “Liceo Classico G. Prati” di Trento.

ESPERIENZE POSTDOTTORATO

- 4 dicembre 2019-3 dicembre 2021:
Titolare di assegno di ricerca INFN presso la Sezione INFN di Pisa;
- 3 luglio 2017-02 luglio 2019:
Borsa postdottorato INFN presso il Centro TIFPA di Trento;
- 28 maggio 2012 - 30 maggio 2017:
Visiting Professor, Eurasian National University, Astana (Kazakhstan);
- aprile-maggio 2012:
Visiting postdoctoral fellow, Università di Trento;
- febbraio-marzo 2012:
Visiting postdoctoral fellow, Consell Superior d’Investigacions Científiques, Barcelona (Spain).

Ulteriori selezioni postdoc vinte

- 2013: UCT/URC postdoctoral research fellowship, University of Cape Town (Sudafrica)
[rifiutata].

Altre attività:

- giugno - settembre 2008:
Operatore TIMSS (Trends in International Mathematics and Science Study), presso l’Istituto IPRASE della Provincia di Trento.

PARTECIPAZIONE A PROGETTI DI RICERCA

- 2012, Project grant
Titolo: Black hole solutions in extended theories of gravity
Host Institute: Università di Trento
Host Professor: Prof. S. Zerbini
Stanziamiento: 2000 EUR;
- 2012, Short Visit Grant of European Science Foundation
Titolo: New Trends and Applications of the Casimir Effect
Host Institute: Consell Superior d'Investigacions Científiques, Barcelona (Spain)
Host Professor: Prof. E. Elizalde
Stanziamiento: 2000 EUR;
- 2009 - 2011:
Exchange Grant Italy-Spain (INFN-MEC) 2008-2009; 2009-2010; 2010-2011
Collaborazione scientifica
Host Institute: Consell Superior d'Investigacions Científiques, Barcelona (Spain)
Host Professors: Prof. E. Elizalde e Prof. S.D. Odintsov
Stanziamiento: 5000 EUR per ogni anno.

ABILITAZIONI SCIENTIFICHE (ASN)

- Valida fino al 28 marzo 2023 + 3 anni: Abilitazione Scientifica Nazionale in Fisica teorica delle interazioni fondamentali (02/A2) per Professore di II Fascia;
- Valida fino all'11 luglio 2024 + 3 anni: Abilitazione Scientifica Nazionale in Astronomia, Astrofisica, Fisica della terra e dei pianeti (02/C1) per Professore II Fascia.

ATTIVITÀ DI INSEGNAMENTO

- settembre 2021-febbraio 2022
Esercitatore del corso di Geometria per ingegneri
Università di Trento;
- settembre 2020-settembre 2021
Incarico di docenza del corso di Analisi III per fisici
Università di Trento;
- settembre 2019-febbraio 2020; settembre 2020-febbraio 2021; settembre 2021-febbraio 2022
Esercitatore del corso di Meccanica Analitica
Università di Trento;
- febbraio- settembre 2018; febbraio - settembre 2019:
Esercitatore del corso di Fisica Generale I per ingegneri
Università di Trento;
- settembre 2012-maggio 2017:
Docente dei corsi di Mathematical methods for physicists; Special Relativity; General Relativity and Cosmology; Topics in Modern Physics
Eurasian National University, Astana (Kazakhstan);
- settembre 2009 - giugno 2010:
Esercitatore del corso di Metodi Matematici per la Fisica
Università di Trento.

ATTIVITÀ DI SUPERVISORE

- Correlatore per la tesi di Laurea Specialistica in Fisica di Bruno Sanna, 17 settembre 2021, Università di Pisa;
- Reviewer per Concurcio Nacional de proyectos FONDECYT 2020, Chile;
- Correlatore per la tesi di Laurea Specialistica in Fisica di Manuel Bertipagani, 21 ottobre 2020, Università di Trento;
- Reviewer per Concurcio Nacional de proyectos FONDECYT 2019, Chile;
- Correlatore per la tesi di Laurea Specialistica in Fisica di Marco Calzá, 20 marzo 2018, Università di Trento;
- Reviewer per Concurcio Nacional de proyectos FONDECYT 2018, Chile.

ATTIVITÀ DI REFERAGGIO

- Reviewer per: CQG; PLB; EPJC; EPJ Plus; GRG; Entropy; Galaxies; Canadian Journal of Physics; IJGMMP; Physics of the Dark Universe; Annals of Physics.

ASSOCIAZIONI SCIENTIFICHE

- Da luglio 2017: affiliato a Università degli Studi di Trento;
- Da novembre 2016: membro del Working Group 1 “Modified Gravity” per la COST Action “Cosmology and Astrophysics Network for Theoretical Advances and Training Actions (CANTATA)”.

PARAMETRI BIBLIOMETRICI (*INSPIRE*, marzo 2022)

- Numero totale di pubblicazioni: 62;
- Numero totale di citazioni: 3200;
- h-index: 27.

PARTECIPAZIONE A CONVEGNI E CONFERENZE NAZIONALI E INTERNAZIONALI

- 2-7 agosto 2021:
“5th International Conference on Holography, String Theory and Discrete Approach ”
Talk (su invito): “Non-singular black holes and mass inflation in $F(R)$ -gravity”
Conferenza on-line dell’Istituto di Fisica Teorica di Hanoi (Vietnam);
- 7 maggio 2020:
seminario (webinar): “Quasi normal modes and echoes of black holes, wormholes and horizonless compact stars”
Università di Pisa (Italia);
- 13-17 aprile 2019:
PAFT 2019
Vietri sul Mare (Italia);

- October 20-21, 2018:
“Foundational problems of black holes and gravitational radiations”
Munich (Germany);
- 24-28 marzo 2018:
PAFT 2018
Talk: “Action growth for static black holes in modified gravity”
Vietri sul Mare (Italia);
- 14-15 dicembre 2017:
FLAG Meeting
Talk: “Action growth for black holes in modified gravity”
Como (Italia);
- 24-28 luglio 2017:
Karl Schwarzschild Meeting 2017
Talk: “Thermodynamical aspects of black holes in modified gravity”
Frankfurt (Germany);
- 08-09 ottobre 2014:
The 2th Eurasian International Conference “Astrophysics, Gravity and Cosmology”
Talks: “Inflation from modified gravity” (plenary section); “Bounce cosmology” (sectional meeting)
Astana (Kazakhstan);
- 19-20 novembre 2012:
The 1th Eurasian International Conference “Astrophysics, Gravity and Cosmology”
Talks: “Black holes in extended theories of gravity” (plenary section); “Finite-time singularities in modified gravity theories” (sectional meeting)
Astana (Kazakhstan);
- 18-19 gennaio 2012:
Riunione Nazionale BO11 (INFN)
Talk: “Black holes in modified gravity: the energy issue”
Bologna (Italia);
- 25-27 ottobre 2011:
Dark Workshop at GGI (Galileo Galilei Institute)
Firenze (Italia);
- 26-30 settembre 2011:
7th international workshop “The Dark Side of the Universe” (DSU 2011)
Beijing (China);
- 30 maggio-03 giugno 2011:
8th Friedmann Seminar
Rio de Janeiro (Brazil);
- 02-03 ottobre 2010:
Conference SIGRAV School of General Relativity and Gravitational Physics
Scuola Normale Superiore di Pisa (Italia);
- 27 settembre-01 ottobre 2010:
XIX SIGRAV Conference on General Relativity and Gravitational Physics
Scuola Normale Superiore di Pisa (Italia);

- 05-09 luglio 2010:
19th International Conference on General Relativity and Gravitation (GR19)
Talk: “Finite-time singularities in Gauss-Bonnet gravity” (parallel section)
Mexico City (Mexico);
- 08-10 marzo 2010:
"Cosmology, the Quantum Vacuum and Zeta Function", in honour of Professor Emilio Elizalde on the occasion of his 60th birthday
Talk: “Finite-time singularities in $\mathcal{F}(R, G)$ gravity and singularity avoidance”
Barcelona (Spain);
- 29 giugno-03 luglio 2009:
Invisible Universe International Conference
Paris (France);
- 08-09 aprile 2009:
Riunione Nazionale BO11 (INFN)
Talk: “Modified gravity models: successes and open problems”
Bologna (Italia);
- 20-21 marzo 2008:
Riunione Nazionale BO11 (INFN)
Talk: “Modified gravity models”
Bologna (Italia);
- 5 dicembre 2008; 3 marzo 2010:
Phd workshop 2008-2009; Phd workshop 2009-2010
Poster section: “From black holes to modified gravity”(con R. Di Criscienzo)
Università di Trento (Italia).

PUBBLICAZIONI

1. M. Bertipagani, M. Rinaldi, L. Sebastiani and S. Zerbini, Phys. Dark Univ. **33** (2021), 100853 [arXiv:2012.15645 [gr-qc]];
2. B. Sanna and L. Sebastiani, Universe **7** (2021), 95 [arXiv:2104.04440 [gr-qc]];
3. A. Casalino, B. Sanna, L. Sebastiani and S. Zerbini, Phys. Rev. D **103** (2021) no.2, 023514 [arXiv:2010.07609 [gr-qc]].
4. A. Casalino and L. Sebastiani, Phys. Dark Univ. **31** (2021), 100771 [arXiv:2004.10229 [gr-qc]].
5. A. Casalino, L. Sebastiani and S. Zerbini, Phys. Rev. D **101** (2020) no.10, 104059 [arXiv:2003.08204 [gr-qc]];
6. A. Casalino, L. Sebastiani, L. Vanzo and S. Zerbini, Phys. Dark Univ. **29** (2020), 100594 [arXiv:1912.09307 [gr-qc]];
7. M. Calzà, A. Casalino, O. Luongo and L. Sebastiani, Eur. Phys. J. Plus **135**, no. 1, 1 (2020) [arXiv:1910.04594 [gr-qc]];
8. L. Sebastiani, L. Vanzo and S. Zerbini, Int. J. Geom. Meth. Mod. Phys. **16**, no. 12, 1950181 (2019) [arXiv:1808.06939 [gr-qc]];
9. A. Casalino, M. Rinaldi, L. Sebastiani and S. Vagnozzi, Class. Quant. Grav. **36**, no. 1, 017001 (2019) [arXiv:1811.06830 [gr-qc]];

10. A. Casalino, M. Rinaldi, L. Sebastiani and S. Vagnozzi, Phys. Dark Univ. **22**, 108 (2018) [arXiv:1803.02620 [gr-qc]];
11. L. Sebastiani, Int. J. Geom. Meth. Mod. Phys. **15**, no. 09, 1850152 (2018) [arXiv:1807.06592 [gr-qc]]. ;
12. M. Calzà, M. Rinaldi and L. Sebastiani, Eur. Phys. J. C **78**, no. 3, 178 (2018) [arXiv:1802.00329 [gr-qc]];
13. L. Sebastiani, L. Vanzo and S. Zerbini, Phys. Rev. D **97** (2018) no.4, 044009 [arXiv:1710.05686 [hep-th]];
14. L. Sebastiani, S. Myrzakul and R. Myrzakulov, Eur. Phys. J. Plus **132**, no. 12, 514 (2017) [arXiv:1712.00738 [gr-qc]];
15. L. Sebastiani, S. Myrzakul and R. Myrzakulov, Eur. Phys. J. Plus **132** (2017) no.10, 433 [arXiv:1702.00064 [gr-qc]];
16. S. D. Odintsov, V. K. Oikonomou and L. Sebastiani, Nucl. Phys. B **923** (2017) 608 [arXiv:1708.08346 [gr-qc]];
17. L. Sebastiani, S. Myrzakul and R. Myrzakulov, Gen. Rel. Grav. **49**, no. 7, 90 (2017) [arXiv:1707.03702 [gr-qc]];
18. E. Elizalde, S. D. Odintsov, L. Sebastiani and R. Myrzakulov, Nucl. Phys. B **921**, 411 (2017) [arXiv:1706.01879 [gr-qc]];
19. L. Sebastiani and R. Myrzakulov, Int. J. Geom. Methods Mod. Phys. **14**, 1750093 (2017) [arXiv:1603.09675 [gr-qc]];
20. L. Sebastiani, S. Vagnozzi and R. Myrzakulov, Adv. High Energy Phys. **2017**, 3156915 (2017) [arXiv:1612.08661 [gr-qc]];
21. R. Myrzakulov and L. Sebastiani, Symmetry **8**, no. 7, 57 (2016) [arXiv:1606.00711 [gr-qc]];
22. G. Cognola, R. Myrzakulov, L. Sebastiani, S. Vagnozzi and S. Zerbini, Class. Quant. Grav. **33**, no. 22, 225014 (2016) [arXiv:1601.00102 [gr-qc]];
23. S. Myrzakul, R. Myrzakulov and L. Sebastiani, Astrophys. Space Sci. **361**, no. 8, 254 (2016) [arXiv:1605.02726 [gr-qc]];
24. R. Myrzakulov, S. Odintsov and L. Sebastiani, Nucl. Phys. B **907**, 646 (2016) [arXiv:1604.06088 [hep-th]];
25. R. Myrzakulov and L. Sebastiani, Astrophys. Space Sci. **361**, no. 6, 188 (2016) [arXiv:1601.04994 [gr-qc]];
26. R. Myrzakulov, L. Sebastiani, S. Vagnozzi and S. Zerbini, Class. Quant. Grav. **33**, 12 (2016) [arXiv:1510.02284 [gr-qc]];
27. R. Myrzakulov and L. Sebastiani, Astrophys. Space Sci. **361**, no. 2, 62 (2016) [arXiv:1512.00402 [gr-qc]];
28. S. Myrzakul, R. Myrzakulov and L. Sebastiani, Int. J. Mod. Phys. D **25**, no. 04, 1650041 (2016) [arXiv:1509.07021 [gr-qc]];
29. L. Sebastiani and R. Myrzakulov, Int. J. Geom. Meth. Mod. Phys. **12**, no. 09, 1530003 (2015) [arXiv:1506.05330 [gr-qc]];
30. R. Myrzakulov, L. Sebastiani, S. Vagnozzi and S. Zerbini, Fund. J. Mod. Phys. **8**, 119 (2015) [arXiv:1505.03115 [gr-qc]];

31. R. Myrzakulov, L. Sebastiani and S. Vagnozzi, *Eur. Phys. J. C* **75**, 444 (2015) [arXiv:1504.07984 [gr-qc]];
32. R. Myrzakulov and L. Sebastiani, *Gen. Rel. Grav.* **47**, no. 8, 89 (2015) [arXiv:1503.04293 [gr-qc]];
33. S. Myrzakul, R. Myrzakulov and L. Sebastiani, *Astrophys. Space Sci.* **357**, no. 2, 168 (2015) [arXiv:1504.03173 [gr-qc]];
34. R. Myrzakulov, L. Sebastiani and S. Zerbini, *Eur. Phys. J. C* **75**, no. 5, 215 (2015) [arXiv:1502.04432 [gr-qc]];
35. R. Myrzakulov, S. Odintsov and L. Sebastiani, *Phys. Rev. D* **91**, no. 8, 083529 (2015) [arXiv:1412.1073 [gr-qc]];
36. S. Myrzakul, R. Myrzakulov and L. Sebastiani, *Eur. Phys. J. C* **75**, no. 3, 111 (2015) [arXiv:1501.01796 [gr-qc]];
37. R. Myrzakulov and L. Sebastiani, *Astrophys. Space Sci.* **357**, no. 1, 5 (2015) [arXiv:1411.0422 [gr-qc]];
38. R. Myrzakulov and L. Sebastiani, *Astrophys. Space Sci.* **356**, no. 1, 205 (2015) [arXiv:1410.3573 [gr-qc]];
39. D. Momeni, R. Myrzakulov, L. Sebastiani and M. R. Setare, *Int. J. Geom. Meth. Mod. Phys.* **12**, 1550015 (2015) [arXiv:1210.7965 [hep-th]];
40. S. Myrzakul, R. Myrzakulov and L. Sebastiani, *Astrophys. Space Sci.* **353**, 667 (2014) [arXiv:1406.1576 [gr-qc]];
41. K. Bamba, R. Myrzakulov, S. D. Odintsov and L. Sebastiani, *Phys. Rev. D* **90**, 043505 (2014) [arXiv:1403.6649 [hep-th]];
42. R. Myrzakulov and L. Sebastiani, *Astrophys. Space Sci.* **352**, 281 (2014) [arXiv:1403.0681 [gr-qc]];
43. S. Myrzakul, R. Myrzakulov and L. Sebastiani, *Astrophys. Space Sci.* **350** (2014) 845 [arXiv:1311.6939 [gr-qc]];
44. L. Sebastiani, G. Cognola, R. Myrzakulov, S. D. Odintsov and S. Zerbini, *Phys. Rev. D* **89**, 023518 (2014) [arXiv:1311.0744 [gr-qc]];
45. L. Sebastiani, D. Momeni, R. Myrzakulov and S. D. Odintsov, *Phys. Rev. D* **88**, 104022 (2013) [arXiv:1305.4231 [gr-qc]];
46. R. Di Criscienzo, R. Myrzakulov and L. Sebastiani, *Class. Quant. Grav.* **30** (2013) 235013 [arXiv:1306.4750 [gr-qc]];
47. R. Myrzakulov, L. Sebastiani and S. Zerbini, *Galaxies*, 1 (2013) [arXiv:1307.4854 [gr-qc]];
48. G. Cognola, R. Myrzakulov, L. Sebastiani and S. Zerbini, *Phys. Rev. D* **88**, 024006 (2013) [arXiv:1304.1878 [gr-qc]];
49. R. Myrzakulov, L. Sebastiani and S. Zerbini, *International Journal of Modern Physics D* Vol. 22, No. 9 1330017 (2013) [arXiv:1302.4646 [gr-qc]];
50. R. Myrzakulov, L. Sebastiani and S. Zerbini, *Gen. Rel. Grav.* **45**, 675 (2013) [arXiv:1208.3392 [gr-qc]];
51. G. Cognola, E. Elizalde, L. Sebastiani and S. Zerbini, *Phys. Rev. D* **86**, 104046 (2012) [arXiv:1208.2540 [gr-qc]];

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53. E. Elizalde, S. D. Odintsov, L. Sebastiani and S. Zerbini, *Eur. Phys. J. C* **72** (2012) 1843 [arXiv:1108.6184 [gr-qc]].
54. G. Cognola, O. Gorbunova, L. Sebastiani and S. Zerbini, *Phys. Rev. D* **84** (2011) 023515 [arXiv:1104.2814 [gr-qc]];
55. L. Sebastiani and S. Zerbini, *Eur. Phys. J. C* **71** (2011) 1591 [arXiv:1012.5230 [gr-qc]];
56. E. Elizalde, S. Nojiri, S. D. Odintsov, L. Sebastiani and S. Zerbini, *Phys. Rev. D* **83** (2011) 086006 [arXiv:1012.2280 [hep-th]];
57. E. Bellini, R. Di Criscienzo, L. Sebastiani and S. Zerbini, *Entropy* **12** (2010) 2186 [arXiv:1009.4816 [gr-qc]];
58. G. Cognola, E. Elizalde, L. Sebastiani and S. Zerbini, *Phys. Rev. D* **83** (2011) 063003 [arXiv:1007.4676 [hep-th]];
59. L. Sebastiani, *Eur. Phys. J. C* **69** (2010) 547 [arXiv:1006.1610 [gr-qc]];
60. O. Gorbunova and L. Sebastiani, *Gen. Rel. Grav.* **42** (2010) 2873 [arXiv:1004.1505 [gr-qc]];
61. K. Bamba, S. D. Odintsov, L. Sebastiani and S. Zerbini, *Eur. Phys. J. C* **67** (2010) 295 [arXiv:0911.4390 [hep-th]];
62. G. Cognola, E. Elizalde, S. Nojiri, S. D. Odintsov, L. Sebastiani and S. Zerbini, *Phys. Rev. D* **77** (2008) 046009 [arXiv:0712.4017 [hep-th]].

Proceedings:

1. L. Sebastiani, *J. Phys. Conf. Ser.* **942**, no. 1, 012016 (2017) [arXiv:1709.09986 [gr-qc]].
2. K. Bamba, A. Lopez-Revelles, R. Myrzakulov, S. D. Odintsov and L. Sebastiani, *TSPU Bulletin* 3 (128), 2012, n 13 p.19-24 (2012) [arXiv:1301.3049 [gr-qc]];
3. G. Cognola, L. Sebastiani and S. Zerbini, *Contribution to MG13 Proceedings, Stockholm* (2012) [arXiv:1301.3031 [gr-qc]];
4. L. Sebastiani, *Springer Proc. Phys.* **137** (2011) 261 [arXiv:1008.3041 [gr-qc]];
5. G. Cognola, L. Sebastiani and S. Zerbini, *Proceeding of 12th Marcel Grossmann Meeting on General Relativity (MG 12, 2009)* [arXiv:1006.1586 [gr-qc]].

Curriculum vitae di Omar Zanusso

Aggiornato al 1 aprile 2022

Informazioni professionali

Università di Pisa
Dipartimento di Fisica
Largo Bruno Pontecorvo 3, 56127 Pisa

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Email: omar.zanusso@unipi.it

Informazioni personali

OMISSIS

Recapiti eletti ai fini della procedura

Domicilio: OMISSIS
Telefono personale:
Email:

Educazione universitaria e dottorato

- Laurea triennale, Università degli Studi di Trieste
Titolo della tesi: **Statistiche frazionarie in sistemi bidimensionali**
Conseguita il 29/09/2003
Supervisore: Prof. G. Calucci (Università degli Studi di Trieste)
- Laurea specialistica, Università degli Studi di Trieste
Titolo della tesi: **Sul comportamento asintotico delle teorie della materia in presenza della gravità**
Conseguita il 25/09/2007
Supervisore: Prof. R. Percacci (SISSA Trieste)
- Studente di Ph.D., SISSA
Dissertazione: **Selected applications of functional renormalization group**
Dottorato in fisica astroparticellare conseguito il 22/09/2010
Supervisori: Prof. R. Percacci (SISSA Trieste); Dr. G. P. Vacca (INFN Bologna)

Progetti finanziati

- Titolo: **The true quantum metric of quantum gravity**, Grant ZA 958/2-1, 140K EUR, finanziato da DFG
Principal investigator e unico beneficiario da 01/04/18 a 30/04/19, joint investigator da 01/05/19 a 31/10/20.
Attività: Ricerca nell'ambito della gravità quantistica; il grant è stato trasferito a Prof. Gies (FSU, Jena) in seguito al mio passaggio a UniPi, con i restanti mesi abbiamo finanziato A. Ugolotti (FSU, Jena) che ho personalmente supervisionato.

Abilitazione scientifica

- **ASN Settore Concorsuale 02/A2 seconda fascia** conseguita nel primo quadrimestre 2016-17
- In attesa dei risultati 02/A2 prima fascia, secondo quadrimestre 2021-22

Lavoro e visite scientifiche

- **Post-doc**, Institute of Physics & PRISMA Cluster of Excellence, Mainz (Germania)
Ricerca coordinata da Dr. F. Saueressig per Emmy-Noether program (Grant SA/1975 1-1)
Partecipazione all'attività di ricerca del gruppo di Prof. M. Reuter e Dr. F. Saueressig
Ottobre 2010 – Marzo 2013
- **Post-doc**, Faculty of Science, Nijmegen (Paesi Bassi)
Gruppo di ricerca coordinato da Prof. R. Loll e Dr. F. Saueressig (Grant SA/1975 1-1)
Attività di ricerca e insegnamento in qualità di esercitatore per Dr. F. Saueressig
Aprile 2013 – Agosto 2014
- **Post-doc**, Theoretisch-Physikalisches Institut, Jena (Germania)
Gruppo di ricerca coordinato da Prof. A. Wipf e Prof. H. Gies (Grants GI 328/7-1 e GI 328/6-2)
Partecipazione attiva e continuativa alla scuola di dottorato "research and training group" GRK 1523/2
Settembre 2014 – Ottobre 2016, Marzo 2017 – Settembre 2017
- **Visiting scientist**, INFN Bologna, Collaborazione scientifica con Dr. G. P. Vacca
Novembre 2016 – Gennaio 2017, Ottobre 2017 – Novembre 2017
- **Visiting scientist**, INFN Catania & OACT, Collaborazione scientifica con Dr. A. Bonanno
Maggio 2017 – Giugno 2017
- **Post-doc**, Theoretisch-Physikalisches Institut, Jena (Germania)
PI di "The true quantum metric of quantum gravity" (DFG Grant ZA 958/2-1)
Aprile 2018 – Aprile 2019
- **Ricercatore a tempo determinato A (RTDA)**, Dipartimento di Fisica, Università di Pisa
Insegnamento del corso semestrale "Teorie della gravitazione" per secondo semestre quarto anno
Maggio 2019 – presente

Attività didattica

- Docente del corso **Teorie della gravitazione** secondo semestre, a.a. 2019-20, 2020-21, 2021-22
presso l'Università di Pisa (il corso è un seguito di GR orientato verso teoria dei campi classica)
Attività principali: totale 54 ore/anno, 9CFU. Info: [e-learning](#) Università di Pisa
- Docente del corso **Effective actions in statistical and quantum field theory**, primo semestre a.a. 2018-19,
presso l'Università di Jena. Attività principali: insegnamento totale 28 ore (14 settimane, 6CF), preparazione
per esercitatore (altre 28 ore). Info: [Friedolin website](#); Materiale didattico: [tpi.uni-jena.de](#)
- Insegnante sostitutivo ed assistente di **Quantum Mechanics** del Prof. H. Gies a.a. 2015-2016 presso Università
di Jena in Germania. Attività principali: 8 ore frontali (due settimane in sostituzione di Gies), assistente esami.
- Esercitatore per il corso semestrale **Lie algebras in Particle Physics** del Prof. F. Saueressig
a.a. 2013-14, presso Università di Nijmegen. Attività principali: 20 ore frontali esercitatore, 2 ore lezione
Differential geometry and Lie groups, preparazione di tutto il materiale per le esercitazioni, assistente esami.

Attività di supervisione

Supervisione di uno studente di PhD presso UniPi:

- D. Sauro, tema della ricerca: metric-affine theories of gravity

Co-supervisione di svariati studenti di PhD durante gli anni da postdoc:

- Coordinazione di A. Ugolotti (nei 12 mesi in cui era finanziato dal grant DFG: ZA 958/2-1, Jena)
Nota: in seguito al mio passaggio a UniPi, abbiamo concordato con il DFG che il mio grant fosse trasferito a Ugolotti in qualità di studente senior. Il contratto di Ugolotti era assimilabile a quello di un postdoc.

- Supervisione “giornaliera” di M. Demmel (PhD student, 2011-14, Mainz e Nijmegen)
Nota: primo significativo impegno di supervisione; abbiamo lavorato spalla a spalla per due anni e mezzo.
- Co-supervisione 50% di R. Martini (PhD student, 2017-19, Jena).
Nota: l’altro supervisore era Prof. H. Gies. Martini ha lavorato su due progetti indipendenti.
- Contributi di varia entità alla supervisione dei PhD: K. Groh (Mainz), R. Flore e T. Hellwig (Jena).
Nota: le tesi di dottorato di questi tre studenti hanno ricevuto contributi significativi ($> 50\%$) dai progetti che abbiamo portato avanti sotto la mia supervisione.

Supervisione di sette laureandi magistrali presso UniPi. Nota: tutti i miei ex studenti sono occupati e quasi tutti stanno proseguendo la carriera accademica con un PhD.

- M. Martinucci, *Un approccio alla gravità massiva con il gruppo di rinormalizzazione* (06/2020)
- F. Del Porro, *Symmetries and renormalization of $2 + \epsilon$ dimensional Unimodular Dilaton Gravity* (10/2020)
- M. Romoli, *Higher derivative NLSM and the construction of a critical 4-dimensional brane* (12/2020)
- S. Kanka, *Effective description of fluid membranes and quantum gravity* (04/2021)
- F. Artuso, *On the critical issues of Higher Derivative Gravity and their possible solutions* (06/2021)
- O. Gelber, *The taste of supersymmetry in critical Yukawa models: from one to four flavours* (12/2021)
- E. Zippo, *Yang-Mills in 5 dimensions: theory and practice of Asymptotic Safety* (02/2022)

Supervisione di un laureando triennale presso UniPi:

- F. Ambrosino, *Effective Lagrangian description for Quantum Gravity at Mesoscopic Scales* (06/2021)
Nota: Ambrosino è uno studente eccezionale e ora frequenta il master a Oxford.

Interessi scientifici

- Teoria dei campi
- Gruppo di rinormalizzazione
- Teorie di campo conformi
- Modelli critici in meccanica statistica
- Gravità quantistica

Pubblicazioni

In preparation for 2022

- C. Bonati, O. Zanusso and E. Zippo
Yang-Mills in $5d$: theory and practice of asymptotic safety
Nota: Discute il completamento UV di teorie di gauge in $d > 4$
- O. Gelber and O. Zanusso
The taste of supersymmetry in critical Yukawa models: from one to four flavours
Nota: Esplora SUSY come simmetria emergente in modelli di Yukawa $3d$

Preprints

- D. Sauro and O. Zanusso
The origin of Weyl gauging in metric-affine theories
arXiv:2203.08692 [hep-th]
Nota: under review
- A. Stergiou, G. P. Vacca and O. Zanusso
Weyl Covariance and the Energy Momentum Tensors of Higher-Derivative Free Conformal Field Theories
arXiv:2202.04701 [hep-th]
Nota: under review
- M. Romoli and O. Zanusso
A different kind of four dimensional brane for string theory
arXiv:2110.05584 [hep-th]
Nota: under review

Pubblicazioni peer-reviewed

- M. Safari, A. Stergiou, G. P. Vacca and O. Zanusso
Scale and Conformal Invariance in Higher Derivative Shift Symmetric Theories
Journal reference: JHEP **02** (2022), 034
- R. Martini, A. Ugolotti and O. Zanusso
The Search for the Universality Class of Metric Quantum Gravity
Journal reference: Universe **7** (2021) no.6, 162
- R. Ben Alì Zinati, A. Codello and O. Zanusso
Multicritical hypercubic models
Journal reference: JHEP **08** (2021), 060
- R. Martini, A. Ugolotti, F. Del Porro and O. Zanusso
Gravity in $d = 2 + \epsilon$ dimensions and realizations of the diffeomorphisms group
Journal reference: Eur. Phys. J. C **81** (2021) no.10, 916
- A. Codello, M. Safari, G. P. Vacca, O. Zanusso
Multicritical Landau-Potts field theory
Journal reference: Phys. Rev. D **102**, no. 12, 125024 (2020)
- M. Safari, G. P. Vacca, O. Zanusso
Crossover exponents, fractal dimensions and logarithms in Landau-Potts field theories
Journal reference: Eur. Phys. J. C **80**, no. 12, 1127 (2020)
- A. Codello, M. Safari, G. P. Vacca, O. Zanusso
On critical models with $N \leq 4$ scalars in $d = 4 - \epsilon$
Journal reference: Phys. Rev. D **102**, 065017 (2020)
- R. Ben Alì Zinati and O. Zanusso
RG and logarithmic CFT multicritical properties of randomly diluted Ising models
Journal reference: JHEP **12**, 105 (2020)
- M. Becker, C. Pagani, O. Zanusso
Fractal geometry of higher derivative gravity
Journal reference: Phys. Rev. Lett. **124** (2020) no.15, 151302
- A. Codello, M. Safari, G. P. Vacca, O. Zanusso
Symmetry and universality of multi-field interactions in $6 - \epsilon$ dimensions
Journal reference: Phys. Rev. D **101**, 065002 (2020)
- S. A. Franchino-Viñas, T. de Paula Netto, I. L. Shapiro and O. Zanusso
Form factors and decoupling of matter fields in four-dimensional gravity
Journal reference: Phys. Lett. B **790**, 229 (2019)

- R. Martini and O. Zanusso
Renormalization of multicritical scalar models in curved space
Journal reference: Eur. Phys. J. C **79**, no. 3, 203 (2019)
- A. Codello, M. Safari, G. P. Vacca, O. Zanusso
Leading order CFT analysis of multi-scalar theories in $d > 2$
Journal reference: Eur. Phys. J. C **79**, no. 4, 331 (2019)
- T. G. Ribeiro, I. L. Shapiro, O. Zanusso
Gravitational form factors and decoupling in 2D
Journal reference: Phys. Lett. B **782**, 324 (2018)
- B. S. Merzlikin, I. L. Shapiro, A. Wipf, O. Zanusso
Renormalization group flows and fixed points for a scalar field in curved space with nonminimal $F(\phi)R$ coupling
Journal reference: Phys. Rev. D **96**, 125007 (2017)
- A. Codello, M. Safari, G. P. Vacca, O. Zanusso
New universality class in three dimensions: The critical Blume-Capel model
Journal reference: Phys. Rev. D **96**, 081701 (2017)
- H. Gies, T. Hellwig, A. Wipf, O. Zanusso
A functional perspective on emergent supersymmetry
Journal reference: JHEP **1712** (2017), 132
- A. Codello, M. Safari, G. P. Vacca, O. Zanusso
Functional perturbative RG and CFT data in the ϵ -expansion
Journal reference: Eur. Phys. J. C **78**, 30 (2018)
- A. Codello, M. Safari, G. P. Vacca, O. Zanusso
Leading CFT constraints on multi-critical models in $d > 2$
Journal reference: JHEP **1704** (2017) 127
- L. Zambelli, O. Zanusso
The Lee-Yang model from the functional renormalization group
Journal reference: Phys. Rev. D **95**, 085001 (2017)
- T. Hellwig, A. Wipf, O. Zanusso
Scaling and superscaling solutions from the functional renormalization group
Journal reference: Phys. Rev. D **92**, 085027 (2015)
- M. Demmel, F. Saueressig, O. Zanusso
A proper fixed functional for four-dimensional Quantum Einstein Gravity
Journal reference: JHEP **1508** (2015) 113
- M. Demmel, F. Saueressig, O. Zanusso
RG flows of Quantum Einstein Gravity in the linear-geometric approximation
Journal reference: Annals of Phys. **359** (2015)
- N. Alkofer, F. Saueressig, O. Zanusso
Spectral dimensions from the spectral action
Journal reference: Phys. Rev. D **91**, 025025 (2015)
- O. Zanusso
Effective models of membranes from symmetry breaking
Journal reference: Phys. Rev. E **90**, 052110 (2014)
- M. Demmel, F. Saueressig, O. Zanusso
RG flows of Quantum Einstein Gravity on maximally symmetric spaces
Journal reference: JHEP **1406** (2014) 026
- A. Codello, M. Demmel, O. Zanusso
Scheme dependence and universality in the functional renormalization group
Journal reference: Phys. Rev. D **90**, 027701 (2014)

- N. Brouzakis, A. Codello, N. Tetradis, O. Zanusso
Quantum corrections in Galileon theories
Journal reference: Phys. Rev. D 89, 125017 (2014)
- A. Codello, O. Zanusso
Renormalization Group Flow of Hexatic Membranes
Journal reference: Phys. Rev. E 88, 022135 (2013)
- A. Codello, N. Tetradis, O. Zanusso
The renormalization of fluctuating branes, the Galileon and asymptotic safety
Journal reference: JHEP 1304 (2013) 036
- M. Demmel, F. Saueressig, O. Zanusso
Fixed-functionals of three-dimensional quantum Einstein gravity
Journal reference: JHEP 1211 (2012) 131
- R. Flore, A. Wipf, O. Zanusso
Functional renormalization group of the non-linear sigma model and the $O(N)$ universality class
Journal reference: Phys. Rev. D 87, 065019 (2013)
- A. Codello, O. Zanusso
On the non-local heat kernel expansion
Journal reference: J. Math. Phys. 54, 013513 (2013)
- A. Codello, O. Zanusso
Fluid Membranes and 2d Quantum Gravity
Journal reference: Phys. Rev. D 83: 125021 (2011)
- M. Fabbrichesi, R. Percacci, A. Tonero, O. Zanusso
Asymptotic Safety and the gauged $SU(N)$ non-linear Sigma Model
Journal reference: Phys. Rev. D 83: 025016 (2011)
- G. P. Vacca, O. Zanusso
Asymptotic Safety in Einstein Gravity and Scalar-Fermion Matter
Journal reference: Phys. Rev. Lett. 105: 231601 (2010)
- R. Percacci, O. Zanusso
One loop beta functions and fixed points in Higher Derivative Sigma Models
Journal reference: Phys. Rev. D 81: 065012 (2010)
- O. Zanusso, L. Zambelli, G. P. Vacca, R. Percacci
Gravitational corrections to Yukawa systems
Journal reference: Phys. Lett. B 689: 90-94 (2010)

Unpublished preprints

- K. Groh, F. Saueressig, O. Zanusso
Off-diagonal heat-kernel expansion and its application to fields with differential constraints
arXiv:1112.4856 [math-ph]
Nota: Pigiante mai pubblicato a causa della diaspora degli autori, ma divenuto molto importante per la letteratura di asymptotic safety

Reviews (peer-reviewed)

- A. Codello, M. Safari, G. P. Vacca, O. Zanusso
Multi-critical multi-field models: a CFT approach to the leading order
Journal reference: Invited review pubblicata in Universe 5, no. 3, 135 (2019)
- S. A. Franchino-Viñas, T. de Paula Netto and O. Zanusso
Vacuum effective actions and mass-dependent renormalization in curved space
Journal reference: Invited review pubblicata in Universe 5, no. 3, 67 (2019)

Proceedings

- M. Demmel, F. Saueressig, O. Zanusso
Fixed-functionals in asymptotically safe gravity
 Conference: Proceedings of 13th Marcel Grossmann Meeting
 Nota: contiene materiale inedito sui troncamenti $f(R)$ in asymptotic safety
- F. Saueressig, K. Groh, S. Rechenberger, O. Zanusso
Higher Derivative Gravity from the Universal Renormalization Group Machine
 Journal reference: PoS (EPS-HEP2011) 124
 Nota: contiene materiale inedito su higher derivative gravity e functional RG

Conferenze

Come organizzatore o simili:

- Organiser of the workshop “Gravity and Other Fields Under the Volcano” (Catania, 2019)
- Organiser of the 2015 Workshop on Strongly-Interacting Field Theories (SIFT2015), Jena 2015
- Giudice presso Monitoring Workshop Jena/Graz 2014 (workshop dedicato al monitoraggio degli studenti)
- Giudice presso Monitoring Workshop Jena/Graz/Wien 2015 (monitoraggio degli studenti)

Come relatore plenario e su invito:

- Invited speaker of “Relativistic fermions in flatland: theory and applications” (Trento, 2021)
- Invited speaker of “Bridging perturbative and nonperturbative physics” (Primosten, 2019)
- Invited speaker of “Problemi attuali di fisica teorica” (Salerno, 2019)
- Invited speaker of “Quantum Fields - from fundamental concepts to phenomenological questions” (Mainz, 2018)
- Plenary speaker of 9th International Conference on the Exact Renormalization Group (ERG2018), Parigi 2018
- Invited speaker of “Functional Methods in Hadron and Nuclear Physics” (ECT* Trento, 2017)
- Invited speaker of “Probing the Fundamental Nature of Spacetime with the RG” (Nordita), Stoccolma 2015
- Plenary speaker of 7th International Conference on the Exact Renormalization Group (ERG2014), Lefkada
- Invited speaker at the workshop “Low Energy Challenges for High Energy Physicists” (Perimeter Inst., 2013)
- Plenary speaker of “Asymptotic Safety - 30 Years Later” (Perimeter Institute, 2009)

Breve selezione delle altre conferenze:

- 10th International Conference on the Exact Renormalization Group 2020 (ERG2020), Kyoto 2020
- Quantum Vacuum: Renormalization Group and Anomalies in Cosmology (Mainz, 2019)
- FRGIM - Functional and Renormalization-Group methods (ECT* Trento, 2019)
- 8th International Conference on the Exact Renormalization Group (ERG2016), Trieste 2016
- Workshop on Classical and quantum symmetries in mathematics and physics, Jena 2016
- Deutsche Physikalische Gesellschaft (DPG) Spring Meeting in Mainz 2014
- Workshop on Strongly-Interacting Field Theories 2013 (SIFT2013), Jena
- 6th International Conference on the Exact Renormalization Group (ERG2012), Aussois 2012
- Workshop on Strongly-Interacting Field Theories 2012 (SIFT2012), Jena
- XXIV Workshop on Beyond the Standard Model in Bad Honnef 2012
- 49th Winter School on Theoretical Physics “Physics at all scales: The Renormalization”, Schladming 2011
- 5th International Conference on the Exact Renormalization Group (ERG2010), Corfù 2010

- 49th Cracow School e 2009 ENRAGE Topical School, Zakopane 2009
- 4th International Conference on the Exact Renormalization Group (ERG2008), Heidelberg 2008
- Workshop on Black Holes in General Relativity and String Theory, Veli Lošinj 2008
- “Are there Quantum Jumps? On the Present Status of Quantum Mechanics”, Trieste e Mali Lošinj 2005

Altre attività o competenze

- Organizzazione seminari gruppo teorico di Pisa
- Responsabile locale (con Prof. G. Marozzi) del progetto ACRI – Young Investigators Training Program “Functional and Renormalization Group Methods in Quantum and Statistical Physics” web.infn.it/FRGIM/
- Borsa di studio per la laurea triennale 1000EUR, Banca di Monastier del Sile, 2003
- Referee per PLB, NPB, PRD, PRE, JPA, CLAQG, EPJC, AoP, Universe, Royal Soc. Open Science
- Membro della commissione (Protokol) di due esami di PhD (Mainz, 2011 e 2012)
- Sistemi operativi: Linux, Mac and Windows
- Grande esperienza nell’uso di Mathematica

Riferimenti accademici

Prof. H. Gies	Friedrich-Schiller-Universität Jena holger.gies@uni-jena.de	Dr. G. P. Vacca	INFN Bologna gianpaolo.vacca@bo.infn.it
Prof. F. Saueressig	Radboud Universiteit Nijmegen f.saueressig@hef.ru.nl	Prof. R. Percacci	SISSA Trieste percacci@sissa.it

San Giuliano Terme, 1 aprile 2022