

CURRICULUM VITAE ET STUDIORUM

DR. DENISE BONCIOLI

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CURRENT POSITION

Dec 2019 - Researcher (RTD-B), Department of Physical and Chemical Sciences, University of L'Aquila, L'Aquila, Italy.

RESEARCH INTERESTS

- Astroparticle Physics, Ultra-high-energy cosmic ray and High-Energy Neutrino Physics
 - UHECR (protons and nuclei) propagation in extragalactic photon backgrounds: developer of *SimProp*, a Monte Carlo code that simulates UHECR propagation, released and publicly available to scientific community
 - Extragalactic photon backgrounds: study of uncertainties of astrophysical photon fields and their effect on UHECR observables as energy spectrum and mass composition
 - Interaction processes: in particular, study of models and data for photodisintegration of nuclei and the effect of their uncertainties on UHECR observables as energy spectrum and mass composition
 - Comprehensive description of UHECR data, including detailed studies of systematics related to astrophysical models used and to systematics of measurements, in the context of the “Cosmic Ray Phenomenology” task of the Pierre Auger Collaboration
 - Neutrino fluxes: implications of UHECR scenarios on neutrino fluxes
- Astroparticle Physics, UHECR sources
 - Radiation models in Gamma-Ray Bursts
 - Role of interactions of UHECR nuclei in Gamma-Ray Bursts and Active Galactic Nuclei
 - UHECR sources: constraints about candidate sources coming from predictions of neutrino fluxes
- Nuclear Physics
 - Connections between nuclear physics and UHECR physics: study of nuclear physics reactions in astrophysical photon fields and determination of uncertainties from lack of measurements
- Fundamental Physics
 - Lorentz Invariance Violation in UHECR interactions: tests of LIV in interactions of UHECRs with astrophysical background and in atmospheric showering

PREVIOUS POSITIONS

Oct 2018 - Nov 2019 Postdoc at GSSI (Gran Sasso Science Institute), L'Aquila (Italy), in the Astroparticle group.

Oct 2015 - Sep 2018 Postdoc at DESY (Deutsches Elektronen-Synchrotron), Zeuthen (Germany), in the Theoretical-AstroParticle Group within the NeuCos project *Neutrinos and the origin of cosmic rays*, funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme.

Mar 2013 - Sep 2015 Postdoc at the Laboratori Nazionali del Gran Sasso (Italy), *Experimental and phenomenological aspects of High Energy AstroPhysics*.

Aug 2012 - Jan 2013 Italian co.co.pro (continuous collaboration) contract at the CNISM Research Unit of the University of L'Aquila (Italy), Department of Physics

CARRIER OPPORTUNITIES

Jun 2021 Winner for 2021 of the internal funds of the University of L'Aquila with the project "MAMP: Exploring Multi-messenger Astrophysics with the Modelling and Visualisation of cosmic-ray related Processes" (10 keuro)

Apr 2021 Participation to Starting Horizon ERC 2020 call as Principal Investigator, with the project "MAGIA: Unveiling the sources of the ultra-high-energy cosmic rays with the modelling of MAGnetic fields and Interactions in multi-messenger Astrophysics"; final result: B

Jan 2020 Winner (for the call 2019/2020) of the 36-month fellowship under the INFN Marie Skłodowska-Curie COFUND Fellowship Programme entitled "FELLINI" - Fellowship for Innovation at INFN, with the project "INSIDE: INvestigating Source IDentity", with the total score 98.4/100 - declined.

Oct 2018 Habilitation for Associate Professorship in Experimental Particle Physics, Settore Concorsuale 02/A1 Fisica Sperimentale delle Interazioni Fondamentali (5 ottobre 2018 - 5 ottobre 2024)

Jul 2018 Habilitation for Associate Professorship in Astronomy and Astrophysics, Settore Concorsuale 02/C1 Astronomia, Astrofisica, Fisica della Terra e dei Pianeti (11 luglio 2018 - 11 luglio 2024)

ORGANIZATION OF CONFERENCES AND SCIENTIFIC SEMINARS

Mar 2022 - Member of the Local Organizing Committee of the UHECR Symposium, to be held at GSSI/University of L'Aquila, October 2022.

Feb 2020 - Member of the Committee of the Thursday Morning Science seminars, University of L'Aquila.

2019 Organization of the Conference of the Italian Society of Physics (SIF) (as Secretary of the Local Organizing Committee), L'Aquila, September 23rd-27th 2019.

2018 Convener of the Cosmic-Ray session for the TeVPA conference (TeV Particle Astrophysics, Berlin, August 27th-31st, 2018)

2017 Co-organization of the Workshop "Neutrinos and the Origin of Cosmic Rays", DESY Zeuthen, May 2017

PEER REVIEW AND EDITORIAL BOARD MEMBERSHIP

2020 Reviewer for DFG (Deutsche Forschungsgemeinschaft, English: German Research Foundation)

since 2018 Member of the Editorial Board for Astrophysics of the *Nature Scientific Reports* Journal

since 2018 Referee for *Astroparticle Physics*, PRD

SUPERVISION OF STUDENTS

Oct 2021 - Co-supervision of PhD student Camilla Petrucci, together with Prof. Francesco Salamida, University of L'Aquila

Jan 2019 - Jul 2021 Co-supervision of PhD student Antonio Condorelli, together with Prof. Sergio Petrerà, at GSSI, L'Aquila, Italy (subject: "Study of cosmic-ray interactions in candidate sources. Applications to the interpretation of the energy spectrum and mass composition data of the Pierre Auger Observatory")

Feb 2020 - Oct 2020 Supervision of Master Student Simone Rossoni, University of L'Aquila, L'Aquila, Italy (subject: "Study of the production of high-energy neutrinos in astrophysical environments. Application to binary neutron-star mergers")

- Feb 2020 - Oct 2020 Co-supervision of Master Student Camilla Petrucci, together with Prof. Francesco Salamida, University of L'Aquila, L'Aquila, Italy (subject: "Study of Ultra High Energy Cosmic Ray flux and cosmogenic neutrinos. A comparison with the Pierre Auger Observatory data")
- 2019 Co-supervision of Master student Caterina Trimarelli (subject: "Study of the effects of Lorentz Invariance Violation in Ultra High Energy Cosmic Rays"), together with Prof. Francesco Salamida, University of L'Aquila, L'Aquila, Italy
- 2017 - 2019 Member of PhD Committee as second supervisor (subject of dissertation: "Ultra-high-energy cosmic-ray nuclei and neutrinos from gamma-ray bursts and extragalactic propagation", PhD Student: Jonas Heinze, DESY, Zeuthen, Germany)
- 2016 - 2019 Co-supervision of PhD student Daniel Biehl (subject: "Nuclear Cascades and Neutrino Production in the Sources of Ultra-High Energy Cosmic Ray Nuclei"), together with Dr. Walter Winter, DESY, Zeuthen, Germany
- 2015 Co-supervision of Master student Jonas Heinze (subject: "Cosmogenic neutrinos as secondary messengers of Ultra-high-energy cosmic rays"), together with Dr. Walter Winter, DESY, Zeuthen, Germany
- 2015-2018 Daily contact with Master and PhD students within the NEUCOS group at DESY, Zeuthen, Germany
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TEACHING ACTIVITIES

- 2022 Invited lecturer at the "International School of Physics Enrico Fermi - Foundations of Cosmic Ray Astrophysics" for the course on "Cosmic Ray propagation in extragalactic space and secondary messengers", to be held in Varenna (Lake Como, Italy) June 2022
- 2022 Invited lecturer at the "2022 Hands-on the extreme universe: exploiting the full potential of CTA Science data", Sexten, Italy, Jul 2022
- 2021 Invited lecturer at 1st COST CA18108 Training School "Quantum gravity phenomenology in the multi-messenger approach" for the course on "Cosmic rays: propagation and detection", Corfu (Greece), 27th September - 5th October 2021 (5 hours)
- 2021 - Teaching assistant, Introduction to Modern Physics, Bachelor Degree (University of L'Aquila)
- 2020 - Teaching assistant, General Physics I, at the Department of Civil Engineering, Bachelor Degree (University of L'Aquila)
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EDUCATION

- Oct 2008 - Dic 2011 PhD. in Physics, University of Roma Tor Vergata, Roma (Italy).
Supervisors: Prof. Giorgio Matthiae (University of Roma Tor Vergata), Prof. Sergio Petrera (University of L'Aquila).
Thesis Title: *Study of Extragalactic Propagation of Cosmic Rays. Applications to Pierre Auger Observatory Data.*
- Oct 2005 - Jul 2008 Master, Laurea Magistrale in Astrofisica e Fisica delle Particelle Elementari (Astrophysics and Elementary Particle Physics) - University of L'Aquila, L'Aquila (Italy).
Supervisors: Dr. Aurelio F. Grillo (Laboratori Nazionali del Gran Sasso, Italy), Dr. Roberto Aloisio (Laboratori Nazionali del Gran Sasso, Italy).
Thesis Title: *Propagazione di Raggi Cosmici di Energie Ultra Alte provenienti da sorgenti extragalattiche. Simulazioni con sorgenti da cataloghi, studio delle anisotropie risultanti e confronto con i dati di Auger. (UHECR Propagation from extragalactic sources. Simulations with catalog sources, study of the resulting anisotropies and comparison with Auger data)*
Score: 110/110 cum Laude
- Oct 2000 - Jan 2005 Bachelor, Laurea Triennale in Fisica (Physics) - University of Pisa, Pisa (Italy).
Supervisor: Prof. Elio Fabri (University of Pisa, Italy).
Thesis Title: *Proprietà dei buchi neri ed evidenze osservative (Properties of black holes and observational evidences)*
Score: 106/110

AWARDS AND FELLOWSHIPS

Dic 2012 Winner for the year 2011 of the Award for Thesis in Astroparticle Physics, given by the Roman Association for the Astroparticle Physics (ARAP, associazione romana per le astroparticelle), for the PhD Thesis (1800 euro).

Sep 2011 Special mention by the Scientific Committee of the SIF Congress for the 3rd section - Astroparticle Physics, Astrophysics and Cosmology - for the talk given at the XCVII Congress of the Italian Physics Society (SIF), L'Aquila (Italy): "Measurement of the energy spectrum of cosmic rays using the Pierre Auger Observatory"

Oct 2008 - Dec 2011 Scholarship for the PhD from the University of Roma Tor Vergata, Roma, Italy

EXPERIENCES ABROAD

Oct 2015 - Sep 2018 Postdoc at DESY Zeuthen, Germany

May 2013 Collaboration with Prof. Günter Sigl's group, University of Hamburg, Germany

Aug 2011 Participation to Fluorescence Detector shift at the Pierre Auger Observatory, Argentina

PHD SCHOOLS

Sep 2009 DPG School on Astroparticle Physics, Bad Honnef, Germany

MAJOR COLLABORATIONS

Mar 2019 - Appointed as Leader of the Cosmic Ray Phenomenology Task within the Pierre Auger Collaboration.

Mar 2013 - Cosmic ray Phenomenology Task (Pierre Auger Collaboration)

Oct 2015 - Sep 2018 Theoretical Astroparticle Group, DESY Zeuthen.

Jun 2013 - Sep 2015 TASP, Theoretical Group, LNGS.

Oct 2008 - Jun 2012 Mass Composition Task (Pierre Auger Collaboration)

Oct 2008 - Jun 2012 Spectrum Task (Pierre Auger Collaboration)

Oct 2008 - Jun 2012 Astrophysics and Monte Carlo Simulation Task (Pierre Auger Collaboration)

MEMBERSHIP OF SCIENTIFIC SOCIETIES

Jan 2021 - Member with research assignment, INFN, Laboratori Nazionali del Gran Sasso

Oct 2018 - Jan 2021 Associate member, INFN, Laboratori Nazionali del Gran Sasso

Oct 2018 - Member of the Pierre Auger Collaboration

Apr 2018 - Member of the COST Action CA18108 "Quantum gravity phenomenology in the multi-messenger approach" as Secondary Proposer, in the working group on cosmic rays

Oct 2008 - Oct 2016 Member of the Pierre Auger Collaboration

Oct 2013 - Dec 2016 Associate member, INFN, Laboratori Nazionali del Gran Sasso

Jun 2013 - Sep 2015 Member of TASP (Theoretical Astroparticle Physics) INFN "iniziativa specifica" in the theoretical activity of the Laboratori Nazionali del Gran Sasso

Oct 2008 - Jun 2012 Associate member, INFN, Roma Tor Vergata

SCIENTIFIC OUTPUT

- The number of papers published in international reviews is 108.
- The number of talks presented in conferences is 20 and 10 of them are invited (and plenary) talks.
- The total number of invited talks (conferences + seminars) is 18.
- The h-index is 52 (Inspire).

CARRIER INTERRUPTIONS

Jan 2014 - Jun 2014 Maternity leave

Jul 2007 - Dec 2007 Maternity leave

TALKS AT WORKSHOPS AND CONFERENCES

- Oct 2021 Invited speaker (topical discussion in plenary session) at the Paris Saclay Astroparticle Symposium, UHECR week (October 25-29, 2021): **From UHECRs and multi-messenger observations to sources**
- May 2021 Invited speaker (plenary session) at the Workshop Global Cosmic Ray Observatory (GCOS) (online, May 17-20, 2021): **Relevance of photo-nuclear processes in UHECR interactions**
- Nov 2019 Oral presentation at “XSCRC2019: Cross sections for Cosmic Rays @ CERN”, Nov 13-15 2019, CERN, Geneva, Switzerland: **UHECRs demand nuclear physics. Uncertainties and relevance of photo-nuclear processes for UHECR interactions**
- Sep 2019 Invited speaker (plenary session) at the Conference “Perspectives in Astroparticle Physics from High Energy Neutrinos”, Sep 25-27 2019, Berlin, Germany: **On the common origin of high-energy neutrinos and UHECRs**
- Jun 2019 Invited speaker (plenary session) on behalf of the Pierre Auger Collaboration at the Conference “Recontres de Blois 2019 - Particle Physics and Cosmology”, June 3-7 2019, Blois, France: **Results from the Pierre Auger Observatory in the light of UHECR interactions**
- Dec 2018 Invited speaker (plenary session) at the Workshop “Women in Nuclear and Hadron Theoretical Physics: the last frontier - WTPLF 2018”, December 10-11 2018, Genova, Italy: **Propagation of Cosmic Rays: what do we learn from Nuclear Physics aspects?**
- Mar 2018 Invited speaker (semi-plenary session) at DPG (Deutsche Physikalische Gesellschaft), Wurzburg, March 19-23 2018 (Germany): **UHECR propagation: Interactions and secondary messengers**
- Dec 2017 Oral presentation at Texas Symposium for Relativistic Astrophysics, December 4th - 8th, 2017 (Cape Town, South Africa): **On the use of neutrinos to unveil the UHECR sources: testing traditional and alternative source classes**
- Jul 2017 Oral presentation at 35th International Cosmic Ray Conference (ICRC 2017), July 12th - 20th, 2017 (Busan, South Korea): **Exploring potential cosmic ray accelerators with neutrinos: what do we learn by injecting nuclei in Gamma-Ray Bursts?**
- Poster on behalf of the Pierre Auger Collaboration at 35th International Cosmic Ray Conference (ICRC 2017) 12th July - 20th 2017 (Busan, South Korea): **Probing Lorentz symmetry with the Pierre Auger Observatory**
- May 2017 Oral presentation at NEUCOS Workshop, DESY Zeuthen, Germany: **Extragalactic Propagation of UHECRs**
- Oral presentation at NEUCOS Workshop, DESY Zeuthen, Germany: **Combined source - propagation models: the case of Gamma-Ray Bursts**

- Jan 2017 Invited speaker at Workshop on Future Directions in Theoretical Astroparticle Physics, DESY Zeuthen, Germany: **Surprises from Multi-Messenger Astronomy**
- Sep 2016 Oral presentation at TeVPA 2016 (TeV Particle Astrophysics), September 12th-16th, 2016 (CERN, Geneva, Switzerland): **Nuclear Physics meets the Sources of Cosmic Rays**
- Au 2016 Invited speaker (plenary session) at XLVI International Symposium on Multiparticle Dynamics (ISMD2016), August 29th - September 2nd, 2016 (Jeju, South Korea): **Interactions of UHECRs around the universe: Models for UHECR data interpretation**
- May 2016 Oral presentation at Workshop on Perspectives on the Extragalactic Frontier: from Astrophysics to Fundamental Physics, May 2nd-6th 2016 (ICTP Trieste, Italy): **Cosmogenic neutrinos challenge the cosmic ray proton dip model**
- Feb 2016 Invited speaker at XLVII Arbeitstreffen KernPhysik, February 18th-25th 2016 (Schleching, Germany): **UHECR propagation in extragalactic space: Interactions and Messengers**
- Aug 2015 Oral presentation at 34th International Cosmic Ray Conference (ICRC 2015) 30th July - 6th August 2015 (The Hague, The Netherlands): **Future prospects of testing Lorentz invariance with UHECRs**
- Sep 2013 Invited speaker (plenary session) at CASPAR, Cosmic Rays Acceleration, Sources and Propagation: A Rendez-vous, September 10th-19th 2013 (Hamburg, Germany): **Extra-galactic propagation of cosmic rays**
- Jul 2013 Poster at 33rd International Cosmic Ray Conference (ICRC 2013) 2nd-9th July 2013 (Rio de Janeiro, Brazil): **Propagation of UHECRs in cosmological backgrounds: some results from Sim-Prop**
- May 2013 Oral presentation on behalf of the Pierre Auger Collaboration (plenary session) at RICAP, Roma International Conference on Astroparticle Physics, May 22nd-24th 2013 (Roma, Italy): **Cosmic ray composition with the Pierre Auger Observatory**
- Sep 2011 Oral presentation on behalf of the Auger Collaboration at XCVII Congresso della Società Italiana di Fisica, L'Aquila, September 26th-30th 2011 (L'Aquila, Italy): **Measurement of the energy spectrum of cosmic rays using the Pierre Auger Observatory**

SEMINARS

- May 2021 Invited speaker at the Astroparticle Seminar, University of Hamburg & DESY (online event): **On the way to unveiling the sources of UHECRs: latest results from the Pierre Auger Observatory.**
- Dec 2020 Invited speaker at the Christmas Seminars, Department of Physical and Chemical Science, University of L'Aquila (online event): **Investigating the sources of the cosmic rays.**
- Dec 2020 Invited speaker at the Thursday Morning Science seminars, University of L'Aquila (online event): **Footprints of cosmic-ray interactions.**
- Nov 2020 Invited speaker for the Astroparticle Seminar at the Niels Bohr Institute, Copenhagen, Denmark (online event): **On the way to unveiling the UHECR sources: latest results and their interpretation.**
- Aug 2018 Oral presentation at the DESY Gamma-Science Meeting, DESY Zeuthen (Germany), August 22nd 2018: **Neutrinos and UHECRs from Low-Luminosity Gamma-Ray Bursts**
- Oct 2017 Invited speaker for Astroparticle Seminar at GSSI, L'Aquila: **Interactions of UHECRs and interpretation of UHECR measurements**
- Jan 2017 AT Seminar, DESY Zeuthen, Germany: **Combined source-propagation models for UHECR nuclei**
- Jun 2016 Invited speaker for Seminar at HZDR, Institute of Radiation Physics, Helmholtz Zentrum Dresden Rossendorf (Germany): **Nuclear Physics meets the Sources of Cosmic Rays**
- Jul 2015 Invited speaker for Seminar at DESY, Zeuthen (Germany): **The many effects of UHECR propagation in extragalactic space**

May 2012 Invited speaker for Seminar at Laboratori Nazionali del Gran Sasso (Assergi, Italy): **The Pierre Auger Observatory results and UHECR composition data: a clue for investigating UHECR source models**

May 2010 Oral presentation at Tor Vergata Journal Club, Roma Tor Vergata (Italy): **Ultra High Energy Cosmic Rays**

PROGRAMMING COMPETENCES

Progr. Languages C, C++, Fortran, Shell Programming, html, perl

Operating Systems Unix, Linux, Windows

Data Analysis ROOT, Mathematica, Matlab, LabView, Minuit

Version Control Systems SVN, CVS

Simulation Tools GEANT 4

Text Editors Latex, Microsoft Office tools (Word, Excel, Power Point)

OUTREACH ACTIVITY

- Seminar, Week of Science, Liceo Scientifico Avezzano: “In viaggio dall’universo violento: i raggi cosmici di altissima energia”, March 2022
 - Member of the organization of the Day of Women and Girls in Science (2021, 2022) University of L’Aquila.
 - Member of the organizing committee of “Street Science 2020”, for the realization of the event “Donne e Scienza”, on the topic of women in academia and research.
 - Oral presentation at the event “Scienziate. Storie a confronto”, GSSI, L’Aquila, Italy, during the International Day of Women and Girls in Science, February 2020
 - Member of the Committee of the Asimov Prize in 2019
 - Participation to OCRA (Outreach Cosmic Ray Activities) at GSSI-LNGS-UnivAq, starting from October 2018
 - DESY Annual Report “Particle Physics 2017, Highlights and Annual Report”, paper “Cosmic rays and nuclear physics. When interdisciplinarity matters”
 - Member of the organization of SHARPER 2014, European Research Night, L’Aquila, September 26th, 2014.
 - Guided tours in the underground laboratory of the Laboratori Nazionali del Gran Sasso, L’Aquila, Italy
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OTHER DUTIES

2020 - Member of the working group about the Gender Balance, University of L’Aquila

2019 - Member of the GENERA Network, Gender Equality Network in Physics in the European Research Area

2017/2018 Organization of NEUCOS Seminars at DESY

LANGUAGE SKILLS

- Italian: native speaker
- English: fluent
- German: basic communication skills

OTHER TITLES

- July 2013: Classe di Abilitazione A049 - Matematica e Fisica - per l'insegnamento nelle scuole superiori (qualified for teaching Mathematics and Physics in Italian High Schools).