

# Alessandro Granelli

**Citizenship:** Italian

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**Current position:** Post-doc at the Department of Physics and Astronomy of the University of Bologna, via Irnerio 46, 40126, Bologna, Italy

**Research fields:** Astroparticle Physics, Neutrino Physics and Phenomenology, Leptogenesis, Dark Matter

## Curriculum Vitae

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### Research Experience

*01/11/2022 - 31/10/2025:* **Postdoctoral researcher** at the Department of Physics and Astronomy (**DIFA**) of the **University of Bologna**, Italy, in the Theory and Phenomenology of Fundamental Interactions group, working with Prof. Silvia Pascoli, Dr. Filippo Sala, and a team of Ph.D. students and fellow postdoctoral researchers.

*16/10/2024 - 13/12/2024:* **Visitor researcher** at the University of California - San Diego (**UCSD**), located in La Jolla, San Diego, CA, **USA**, for a two-month in person scientific collaboration funded by the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie Staff Exchange grant agreement No. 101086085-**ASYMMETRY**.

*15/01/2023 - 15/03/2023:* **Visitor researcher** at the **Kavli** Institute for the Physics and Mathematics of the Universe (**IPMU**) - University of Tokyo, located in Kashiwa, Chiba, **Japan**, for a two-month in person scientific collaboration funded by the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie Staff Exchange grant agreement No. 101086085-**ASYMMETRY**.

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### Education

*10/2018-09/2022:* **Ph.D. in Astroparticle Physics** awarded **cum laude** at the **International School for Advanced Studies (SISSA)**, Trieste, Italy, worked under the supervision of Prof. Serguey T. Petcov on the leptogenesis mechanism to generate the matter-antimatter asymmetry of the Universe and with Prof. Piero Ullio on dark matter phenomenology. Final thesis entitled "*Aspects of Leptogenesis Scenarios at Grand Unification and Sub-TeV Scales and Their Possible Low-Energy Tests*".

*09/2013-11/2019:* **Scholarship** for a five years study at the **Galileian School of Higher Education (SGSS)**, Padua, Italy, in the class of **Natural Sciences**.

- 8<sup>th</sup> ranked in the national competition for the class of natural sciences. Only 14 students admitted. The selection consisted on two written exams (general knowledge of scientific subjects and chemistry) and two oral examinations (chemistry and physics).

- Very demanding requirements carried out during each year: attendance to seminars and internal courses, additional to the regular ones provided by the University, with final examinations; average score of at least 27/30 and no less than 24/30 in every single exam (regular and internal).
- *Relevant internal courses*: complements of analysis, complements of algebra, introduction to non-linear partial differential equations, group theory, measure theory, fluid dynamics, open problems in the physics of fundamental interactions, measurements instruments and techniques, complements of quantum mechanics, introduction to string theory, dynamical foundations of statistical mechanics.
- The scholarship ended with a final research project, discussed in front of a commission one year after obtaining the master degree. My final thesis, entitled “*Baryogenesis via Leptogenesis*” and supervised by the external Prof. Serguey T. Petcov (SISSA), consisted on a preliminary study on leptogenesis, the main subject of my Ph.D. project.

*10/2016-10/2018*: **MSc in Physics** awarded with grade **110/110 (cum laude)** from University of Padua, Italy. Final research project with Prof. Francesco D’Eramo entitled “*A novel dark matter mechanism to produce X-ray lines with unique morphology and spectrum*”.

*09/2013-09/2016*: **BSc in Physics** awarded with grade **110/110** from University of Padua, Italy. Final dissertation prepared with Prof. Nicola Bartolo entitled “*Effects of inhomogeneities in the Universe on the propagation of gravitational waves*”.

*09/2008-07/2013*: High-School Diploma, Liceo F. Redi, Arezzo (Italy), in an experimental program named Brocca Scientifico, with great emphasis on physics, mathematics, chemistry and biology. Final Grade 100/100.

## Short-term schools

*14/05/2023-19/05/2023*: Attended the FIPs in the ALPs school dedicated to the physics of feebly-interacting particles held at Les Houches, France.

*07/01/2020-24/01/2020*: Attended the GGI school on Theory of Fundamental Interactions held at the Galileo Galilei Institute (GGI) in Florence, Italy.

*17/06/2018-29/06/2018*: Attended the Summer School on Cosmology held at the Abdus Salam International Center for Theoretical Physics (ICTP) in Trieste, Italy.

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## Conferences, Visits and Seminars

*30/06/2025 - 04/07/2025*: Participated to the 11th Workshop on Flavour Symmetries and Consequences in Accelerators and Cosmology (**FLASY 2025**) at Roma Tre, Rome, Italy and gave a parallel talk on *Low-scale leptogenesis with low-energy Dirac CP-violation*, contribution at [this link](#).

*24/09/2024 - 27/09/2024*: Participated to the **DESY Theory Workshop 2024 - Whispers from the Dark Universe – Particles & Fields in the Gravitational Wave Era** at DESY in Hamburg, Germany, and gave a parallel talk on *Relic Neutrino Background from Cosmic Ray Reservoirs*, contribution at [this link](#).

- 19/09/2024 - 20/09/2024: Participated to the **Lepton Future Collider 2024 LFC24 - Fundamental Interactions at Future Colliders** at SISSA in Trieste, Italy, and gave a plenary talk on *Leptogenesis*, contribution at [this link](#).
- 02/09/2024 - 08/09/2024: Participated to the **Neutrino Oscillation Workshop 2024 (NOW24)** in Otranto (LE), Italy, and gave a talk on *Low-scale leptogenesis with low-energy CPV*, contribution at [this link](#).
- 29/01/2024 - 02/02/2024: Participated to the **7<sup>th</sup> FCC Physics Workshop** at LAPP in Annecy, France, and gave a talk on *Low-scale leptogenesis with Dirac CP-violation*, contribution at [this link](#).
- 11/10/2023 - 13/10/2023: Participated to the **22<sup>nd</sup> International Workshop on Next Generation Nucleon Decay and Neutrino Detectors (NNN23)** in Procida (NA), Italy, and gave the opening talk on *Theoretical Overview of Neutrino Oscillations*, contribution at [this link](#).
- 27/09/2023 - 29/09/2023: Participated to the **New Frontiers in Theoretical Physics - XXXVII Convegno Nazionale di Fisica Teorica** in Cortona (AR), Italy, and gave a firetalk on *Tests of Low-scale Leptogenesis within the Type-I Seesaw Extension*, contribution at [this link](#).
- 15/09/2023: Participated to the 109<sup>o</sup> **Congresso Nazionale Società Italiana di Fisica (SIF)** at the Department of Physics of the University of Salerno ( Fisciano), Italy, and gave a talk on *Neutrinos Beyond the Standard Model*, contribution at [this link](#).
- 05/09/2023 - 08/09/2023: Participated to the **1<sup>st</sup> General Meeting of COST Action COSMIC WISPers (CA21106)** in Bari, Italy, and gave a talk on *Low-scale Leptogenesis with Low-Energy Dirac CP-Violation*, contribution at [this link](#), published proceeding [PoS COSMICWISPers \(2024\) 008](#).
- 28/08/2023 - 01/09/2023: Participated to the **The Invisibles23 Workshop** in Göttingen, Germany, and gave a talk on *Low-scale Leptogenesis with Low-Energy Dirac CP-Violation*, contribution at [this link](#).
- 02/05/2023 - 11/05/2023: Visited the New York University campus of Abu Dhabi (**NYUAD**) for a collaboration with Prof. Francesco Arneodo's experimental group on *Blazar-boosted dark matter* detection at XENONnT. I also gave a seminar on *Leptogenesis within the Type-I Seesaw Extension of the Standard Model*.
- 15/01/2023 - 15/03/2023: Visit at the **IPMU**, Kashiwa, Chiba, Japan for a two-month period. During this period, I have also visited the **Hongo Campus** of the University of Tokyo in Tokyo and **KEK** in Tsukuba, giving seminars there on *Blazar-boosted dark matter* and *Aspects of high-scale leptogenesis with low-energy leptonic CP-violation*.
- 18/07/2022 - 22/07/2022: Participated to the **14<sup>th</sup> Conference on the Identification of Dark Matter (IDM2022)** in Vienna, Austria, and gave a talk on *Blazar-Boosted Dark Matter*, contribution at [this link](#).
- 06/07/2022 - 13/07/2022: Participated to the **XLI International Conference of High Energy Physics (ICHEP 2022)** in Bologna, Italy, and gave a talk on *Blazar-Boosted Dark Matter*, contribution at [this link](#).

30/05/2022 - 04/06/2022: Participated (remotely) to the **XXX International Conference on Neutrino Physics and Astrophysics (NEUTRINO 2022)** in (virtual) Seoul, South Korea, and presented a poster entitled *Aspects of High Scale Leptogenesis with Low-Energy Leptonic CP Violation* (available at this [link](#)).

16/05/2022 - 21/05/2022: Participated (remotely) to the **7<sup>th</sup> Symposium on Neutrinos and Dark Matter in Nuclear Physics (NDM22)** in Asheville (NC), USA, and gave a talk on *Blazar-Boosted Dark Matter*, contribution at [this link](#).

19/03/2022 - 26/03/2022: Participated to the **56<sup>th</sup> Rencontres de Moriond (2022)** in La Thuile (Italy) at the Very High Energy Phenomena of the Universe (VHEPU) session, invited to give a talk on *Blazar-Boosted Dark Matter*, contribution at [this link](#), published proceedings [here](#).

08/09/2021 - 10/09/2021: Participated to the **Barolo Astroparticle Meeting (BAM)** hosting the *PRIN meeting* in Barolo (CN), Italy, and presented a talk on *Aspects of High Scale Leptogenesis with Low-Energy Leptonic CP Violation*, contribution at [this link](#).

26/08/2021 - 03/09/2021: Participated to the **17<sup>th</sup> International Conference on Topics in Astroparticle and Underground Physics (TAUP 2021)**, hosted by IFIC Valencia and held online, and presented the talk entitled: *Aspects of High Scale Leptogenesis with Low-Energy Leptonic CP Violation*, contribution at [this link](#).

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## Teaching activities

16/09/2024 - present: **Lecturer** for the course “**Advanced Standard Model**”, module 3, part of the Advanced Methods in Particle Physics international (master) degree programme of which the University of Bologna is a partner university (web-page at [this link](#)). My lectures concern “**Neutrino Physics**”, and consist of **16 hours** of lessons in class on neutrino interactions in the standard model, neutrino oscillations, masses and mixing, neutrino mass models (seesaw mechanisms), leptogenesis.

26/08/2024 - 28/08/2024: **Lecturer** for the **SUMMER STEM ACADEMY 2024**, summer school organized by the Alumni association of the Galileian School of Higher Education, Padua, and dedicated to selected 4<sup>th</sup>-year high-school students (web-site at [this link](#)). The topic of the lectures was “**Astroparticle Physics**” and consisted of **6 hours** of lessons (in person) on fundamentals of special relativity and quantum mechanics, the particle content of the standard model, the messengers of the Universe (photons, cosmic rays, neutrinos) and the construction of a diffusion-cloud chamber for the detection of cosmic rays.

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## Working Experiences and Other Activities

### Student Representative

24/03/2020-24/03/2022: Representative of the Ph.D. students in Astroparticle Physics (APP) at SISSA. The activity consists on taking part to meetings with professors of the APP area, as well as with the other students’ representatives of the school (Students’ Council). Some important roles of a student representative at SISSA are:

- Ensuring high-quality learning experiences at SISSA (hands on teaching/courses improvement).
- Assisting students of the relevant area and reporting eventual problems to Professors (effective communication at different levels).
- Understanding school departments policies, related to academic and student support.
- Communicating new ideas and concepts within the Student Council and other higher-level committees and bodies (requires public speaking, negotiating, effective communication skills).
- Being an active part of the SISSA community (networking, collegiality, teamwork).

## Organisation of Conferences, Schools and Meetings

- **Local Managing Chair** of the *15th International Neutrino Summer School 2024* 3-14 June, 2024, see [this link](#) for more details;
- **Local and Scientific Organiser** of the *Invisibles School 2024* 24-28 June, 2024 and *Invisibles Workshop* 1-5 July, 2024, see [this link](#) for more details.

## Outreach activities

- Part of the inVISIBILI project ([this link](#)) funded by the European Union's Horizon research and innovation programme under the Marie Skłodowska-Curie grant agreements No. 860881-HIDDeN, Hunting Invisibles: Dark Sectors, Dark matter and Neutrinos. The project consisted in school activities for kids of 5 to 11 years old to illustrate at the basic level the concepts of *invisible* particles, such as neutrinos and dark matter. The activities were accompanied with simple explanations of the physics and work of a researcher in the field, as well as simple experiments performed in class. Everything has been done with particular attention to gender class equality, with a statistical analysis at the end of the project to study how the gender (in)equality is perceived by kids.
- Lecture (in italian) to the last year high school students of Liceo F. Redi, Arezzo (Italy) covering the fascinating aspects of astroparticle physics, including Standard Model of particle physics, thermal history of the Universe, dark matter, matter-antimatter asymmetry of the Universe and dark energy. The lecture also included a short presentation of the Galileian School of Higher Education.
- Lecture (in italian) to the amateur astronomers group (*Gruppo Astrofili*) of Arezzo (Italy) on astroparticle physics, topics included Standard Model of particle physics, thermal history of the Universe, dark matter, matter-antimatter asymmetry of the Universe and dark energy.

## Academic Tutoring

- Co-supervisor of three master students in physics at the University of Bologna. The students are: Margherita Pulga, Enrico Perboni and Giuseppe Cordella.
- Selected as a tutor, on the base of merit, teaching skills and attitudes, evaluated with oral examinations and written exams, in different subjects for the first-year students of Information Engineering at the University of Padua.

⇒ 09/2017-01/2018: (Math4U project) 72h of complementary lessons in Analysis I, preparing the students to the written exam with exercises in class and assisting them via mail.

⇒ 02/2018-06/2018: 50h of tutoring for the course of Linear Algebra and 30h for Physics: exercises in class.

## Proofreader

06/2019-09/2019: Worked for Zanichelli to correct the exercises of a book of Physics intended for high-school students.

## Programming Skills

*Programming Languages and Computational Software:* Python, Mathematica, R (and RStudio), C++.

## Language Skills

*English:* Fluent (C1 TAL level reading and listening, B2 TAL level speaking and writing, CLA, University of Padua).

*Italian:* Mother tongue.

*Spanish:* Basic knowledge (studied in middle school).

*Japanese:* Basic knowledge (I am learning by myself).

## Other Interests

*Music:* Lead singer, guitarist and lyricist in the italian progressive rock band named Tacita Intesa. Recorded two albums: the first one self-titled released on 1<sup>st</sup> June 2014; the second one, named FARO, published on November 2018. Hundreds of CDs sold in Italy and abroad, especially in Japan, where we toured for two concerts in Osaka and Tokyo, in October 2019. This activity requires lots of creativity and organization abilities, as much as public speaking and communication skills.

*Sports:* Tennis player since the age of 6. Amatorial fencer (weapon: épée). Regular runner. Lindy hop dancer (beginner).

## List of Publications

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- [1] A. G. De Marchi, A. Granelli, J. Nava and F. Sala, *Boosted dark matter versus dark matter-induced neutrinos from single and stacked blazars*, [arXiv:2507.12278](#), submitted for publication in JHEP.
- [2] A. G. De Marchi, A. Granelli, J. Nava and F. Sala, *Diffuse astrophysical neutrinos from dark matter around blazars*, [arXiv:2506.06416](#), submitted for publication in Physics Letters B.

- [3] A. Granelli, D. Meloni, M. Parriciatu, J. T. Penedo and S. T. Petcov, *Modular-symmetry-protected seesaw*, [arXiv:2505.21405](#), submitted for publication in JHEP.
- [4] A. Abdullahi, F. Costa, A. G. De Marchi, A. Granelli, J. Hoefken-Zink, Matheus Hostert, Michele Lucente, Elina Merkel, Jacopo Nava, Silvia Pascoli, Salvador Rosauero-Alcaraz and Filippo Sala, *From oversimplified to overlooked: the case for exploring Rich Dark Sectors*, [arXiv:2505.05663](#), submitted for publication in Nuclear Physics B.
- [5] *Neutrino Theory in the Precision Era*, A. Abada, G. Barenboim, T. Bertolez-Martínez, S. Bhattacharjee, S. Bolognesi, ..., A. Granelli, *et al.* [arXiv:2504.00014](#).
- [6] A. Granelli, K. Hamaguchi, M. E. Ramirez-Quezada, K. Shimada, J. Wada and T. Yokoyama, *Insights on the Scale of Leptogenesis from Neutrino Masses and Neutrinoless Double-Beta Decay*, *European Physical Journal C* **85** (2025) 778, [[arXiv:2502.10093](#)].
- [7] A. G. De Marchi, A. Granelli, J. Nava and F. Sala, *Did IceCube discover Dark Matter around Blazars?*, *Physical Review D* **112** (2025) 043042 [[arXiv:2412.07861](#)].
- [8] A. G. De Marchi, A. Granelli, J. Nava and F. Sala, *Relic Neutrino Background from Cosmic-Ray Reservoirs*, *Physical Review D* **111** (2025) 023023 [[arXiv:2405.04568](#)].
- [9] A. Granelli, *Standard and Non-Standard Aspects of Neutrino Physics*, *Universe* **10** (2024) 4, 164 [[arXiv:2403.16308](#)].
- [10] A. Granelli, S. Pascoli and S. T. Petcov, *Low-Scale Leptogenesis with Low-Energy Dirac CP-Violation*, *Physical Review D* **108** (2023) L101302 [[arXiv:2307.07476](#)].
- [11] A. Granelli, K. Hamaguchi, N. Nagata, M. E. Ramirez-Quezada and J. Wada, *Thermal Leptogenesis in the Minimal Gauged  $U(1)_{L_\mu-L_\tau}$  Model*, *Journal of High Energy Physics* **09** (2023) 079 [[arXiv:2305.18100](#)].
- [12] A. Granelli, C. Leslie, Y. F. Perez-Gonzalez, H. Schulz, B. Shuve, J. Turner and R. Walker, *ULYSSES, Universal LeptogeneSiS Equation Solver: Version 2*, *Computer Physics Communications* **291** (2023) 108834, [[arXiv:2301.05722](#)].
- [13] A. Granelli, J. Klarić and S. T. Petcov, *Tests of Low-Scale Leptogenesis in Charged Lepton Flavour Violation Experiments*, *Physics Letters B* **837** (2023) 137643, [[arXiv:2206.04342](#)].
- [14] A. Granelli, P. Ullio, and J.-W. Wang, *Blazar-Boosted Dark Matter at Super-Kamiokande*, *Journal of Cosmology and Astroparticle Physics* **07** (2021) 013, [[arXiv:2202.07598](#)].
- [15] J.-W. Wang, A. Granelli and P. Ullio, *Direct Detection Constraints on Blazar-Boosted Dark Matter*, *Physical Review Letters* **128** (2022) 221104, [[arXiv:2111.13644](#)].
- [16] A. Granelli, K. Moffat and S. T. Petcov, *Aspects of High Scale Leptogenesis with Low-Energy Leptonic CP Violation*, *Journal of High Energy Physics* **11** (2021) 149, [[arXiv:2107.02079](#)].
- [17] A. Granelli, K. Moffat and S. T. Petcov, *Flavoured Resonant Leptogenesis at Sub-TeV Scales*, *Nuclear Physics B* **973** (2021) 115597, [[arXiv:2009.03166](#)].

- [18] A. Granelli, K. Moffat, Y. F. Perez-Gonzalez, H. Schulz and J. Turner, *ULYSSES: Universal LeptogeneSiS Equation Solver*, *Computer Physics Communications* **262** (2021) 107813, [[arXiv:2007.09150](https://arxiv.org/abs/2007.09150)].
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Date: September 22, 2025

A handwritten signature in black ink, reading "Alessandro Granelli". The signature is written in a cursive style with a long, sweeping underline.