

ROJIN BAYATI

EDUCATION

- PhD Student | Cosmology** Nov. 2025-Ongoing
Supervisor: Prof. Marco Raveri, University of Genova, Genova, Italy
- Master of Science | Astrophysics and Cosmology** Oct. 2022-April 2025
Università degli Studi di Padova, Padova, Italy GPA: 110 with honors/110
- Bachelor of Science | Physics** Oct. 2017 – Sep. 2022
Sharif University of Technology, Tehran, Iran GPA: 16.34/20 (Last Two Years: 18.34/20)

RESEARCH EXPERIENCE

- **Doctorate Research: Non-linearities in CMB Power Spectrum** November 2025-ongoing
Supervisor: Prof. Marco Raveri, University of Genova, Genova
Studying the effects of non-linear corrections of the angular power spectrum of CMB on measurements of cosmological parameters and their shifts
- **Research Fellowship: Probing the Nature of Dark Matter through Dwarf Galaxy Density Profiles** May 2025–June 2026
Supervisor: Prof. Paolo Salucci, SISSA, Trieste
Conducting research on the inner structure of dwarf galaxies to constrain the properties of dark matter.
Publication: Bayati, R.; Salucci, P. Dark Halos, Intermediate-Mass BH and Nuclear Stellar Clusters in Dwarf Spheroidals. Universe 2026, 12, 195. <https://doi.org/10.3390/universe12070195>.
- **Master's Thesis: Gravitational Relaxation and Kinetic Theory in Fuzzy Dark Matter** Feb 2024-April 2025
Supervisors: Prof. Sabino Matarrese, Prof. Matteo Viel, University of Padova
Investigated the relaxation processes in Fuzzy Dark Matter (FDM), a model where ultra-light bosons exhibit wave-like density fluctuations affecting gravitational dynamics. Derived analytical expressions for FDM relaxation mechanisms and performed simulations to compare relaxation and density profiles with classical dark matter models.
- **Bachelor's Thesis: Sunspot Fine Structure Analysis** Sep 2020-Jan 2021
Supervisor: Dr. Reza Rezaei
Investigated the fine structure of sunspots, focusing on umbral dots and light bridges. Analyzed competing models for sunspot magnetic fields and conducted a multi-wavelength spectral analysis.
Publication: Bayati R, Review of Sunspots, *Nojourn (Iranian Magazine of Astronomy)*, Vol. 30, Issue 01, p. 66 (2021).

COURSE PROJECTS

- **Activity Recognition Using Deep Learning Model** Jan-Feb 2025
Machine Learning, University of Padova
Instructor: Dr. Michele Rossi
Developed a CNN-based model for classifying human activity from sensor data. Used inception-based residual blocks for automatic feature extraction and compared the performance with an RNN model.
- **Cosmological Evolution of Perturbations and Cosmic Structures** Sep-Dec 2024
Observational Cosmology, University of Padova
Instructors: Dr. Giulia Rodighiero, Dr. Paolo Cassata
Investigated the evolution of perturbations in the cosmic fluid, the peculiar velocity field, and the origin and evolution of cosmic structures. Focused on understanding deviations from homogeneity and their role in the formation of large-scale structures in the universe.
- **Bayesian Physical Reconstruction of Initial Conditions from Large-Scale Structure Surveys** May 2024
Astrostatistics and Cosmology, University of Padova
Instructor: Dr. Michele Liguori

Used Bayesian inference to reconstruct the initial conditions of the universe from large-scale structure surveys. Focused on modeling the evolution of cosmic structures and deriving probabilistic constraints on cosmological parameters. Applied advanced cosmological models for statistical analysis to infer the physical properties of the early universe.

- **Schrödinger Equation Approach to Large-Scale Structure Formation** Oct-Dec 2023
Theoretical Cosmology, University of Padova
Instructor: Prof. Sabino Matarrese
Explored inconsistencies in classical large-scale structure formation models and studied a wave-mechanical approach using the Schrödinger equation. Demonstrated how this method addresses key limitations of traditional models by capturing non-linear growth effects and quantum-like interference patterns in structure formation.
- **Multi-Wavelength Analysis of NGC 1052** Oct-Nov 2022
High Energy Astrophysics Lab, University of Padova
Instructor: Dr. Stefano Coroi
Conducted a multi-wavelength study of the active galactic nucleus (AGN) in NGC 1052 using *Swift* XRT and UVOT data. Performed photometric analysis, generated light curves, and applied spectral fitting techniques with DS9 and XSPEC to examine high-energy emission properties.
- **Anomalous Magnetic Moment of Muon $g-2$** April 2022
Particle Physics Instructor: Dr. Amin Faraji Astaneh
Investigated the theoretical models contributing to the anomalous magnetic moment of the muon ($g-2$) with a focus on quantum electrodynamics (QED) corrections and explored the potential role of new physics beyond the Standard Model.
- **Investigation of Two Colliding Cores in Fuzzy Dark Matter (FDM)** March-April 2021
Astrophysics, Sharif University of Technology
Instructor: Prof. Sohrab Rahvar
Analyzed two colliding cores in a fuzzy dark matter halo, examining the quantum effects on the density and dynamics. This project sought to understand the interaction between core structures in FDM and its implications for galaxy formation.
- **Hypernovae** Nov-Dec 2020
Introduction to Astronomy, Sharif University of Technology
Instructor: Dr. Reza Rezaei
Investigated the astrophysical properties and theoretical models of hypernovae, focusing on their mechanisms, explosion dynamics, and the role they play in the chemical enrichment of galaxies.
- **Numerical Solutions of Friedmann Equation,** Dec 2020
Cosmology, Sharif University of Technology
Instructor: Prof. Sohrab Rahvar
Developed numerical methods to solve the Friedmann equations, studying the evolution of the universe under various cosmological models. Studied the influence of different dark energy and dark matter parameters on the expansion history of the universe.

SKILLS

Programming: Python (NumPy, SciPy, TensorFlow, Keras, PyTorch, Scikit-learn, Pandas), MATLAB, C++/C
Data Science and Machine Learning: Deep learning, Neural networks, Data analysis techniques, Mathematical modeling
Astrophysical Software: HEASoft, TopCat, DS9
Statistical Methods: Bayesian inference, Markov Chain Monte Carlo (MCMC) sampling
Other: Microsoft Office Suite, LaTeX

WORK EXPERIENCE

- **Professor Assistant for "Waves" Course** (Dr. Amin Astaneh Faraji) Oct 2021-March 2022
Assisted in teaching undergraduate-level wave physics, developed instructional materials, graded assignments, and led problem-solving sessions.
- **Researcher and Reviewer at "Your Dose of Curiosity" (YouTube Channel)** Nov 2021 - May 2022
Conducted research on astrophysics topics, reviewed scientific content, and contributed to scriptwriting for educational videos.

- **Physics Project/Research Teacher at Farzanegan High School** Aug 2021 - June 2022
Mentored high school students in research projects, guiding them through scientific methodology, conducting experiments, and academic writing.
- **Translator at Takaneh Physics Journal** Oct 2018 - Sep 2020
Translated technical physics articles from English to Persian.
- **Tutor (High School and University Courses)** July 2017 - May 2021
Provided one-on-one tutoring in physics, mathematics, and programming, assisting students with problem-solving and conceptual understanding.
- **English Teacher** (Pardisan Language Institute, Hadis Language School) 2015 - 2020
Designed and delivered English lessons for various proficiency levels, focusing on grammar, conversation, and exam preparation.

HONORS

- Graduated with honors (110/110 cum laude) – MSc in Astrophysics and Cosmology, University of Padova, 2025

LANGUAGES

- **English:** Fluent (IELTS 8.5)
- **Italian:** Intermediate (currently improving)
- **Persian:** Native

REFERENCES

Available upon request. Primary referees include:

- **Prof. Marco Raveri**
Email: Marco.Raveri@unige.it
- **Prof. Matteo Viel**
Email: matteoviel@gmail.com
- **Prof. Sabino Matarrese**
Email: sabino.matarrese@pd.infn.it

LINKS

Below you can find the links to some of my work:

Master's Thesis: Gravitational Relaxation and Kinetic Theory in Fuzzy Dark Matter

https://drive.google.com/file/d/1RhdkUj2FXe-2I8Cw1NpWDWYUYBqdC0cb/view?usp=drive_link

Schrödinger Equation Approach to Large-Scale Structure Formation

<https://drive.google.com/file/d/1esI2hu15eLlXvx6W0CtUBobzBkVjrxZE/view?usp=sharing>

Bachelor's Thesis: Sunspot Fine Structure Analysis

https://drive.google.com/file/d/1Rt-if4ewaIPePJTEfBGDwUcODGRUC/view?usp=drive_link

Genova, July 30, 2026

