Francesco Iacovelli

Contact

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Languages

Italian (Native), English (Fluent), French (Intermediate).

Programming Languages

Advanced level: C, C++, R, Python, MATLAB, Microsoft Office, LaTeX.
Intermediate level: Visual Basic, Arduino, Wolfram Mathematica, FORTRAN, CSS.

Skills and Knowledge

Cosmology and Gravity, Simulations and Data Analysis, Responsibility, Team working, Leadership, Flexibility, Teaching.

Hobbies

Percussion instruments, photography, tennis, hiking.

Education

2024–current **Assistant Research Scientist, Postdoctoral Fellowship** Johns Hopkins University, Baltimore, US
Gravitational waves, Astrophysics and Cosmology. In October 2024 I joined the Astrophysics group at Johns Hopkins University as an Assistant Research Scientist under a Miller Postdoctoral Fellowship. Having the possibility of conducting my research independently, I plan to focus on data analysis for future gravitational wave instruments, with a principal focus on extracting astrophysical and cosmological information from gravitational–wave sources, working in close contact with the groups of Prof. E. Berti and Prof. M. Kamionkowski.

2020–2024 **Ph.D.** in Theoretical Physics University of Geneva, Geneva, Switzerland
Gravitational waves, Cosmology, Modified Gravity and Computing. On November 1, 2020, I moved to Geneva to complete my education, under the supervision of Prof. M. Maggiore. The core focus of my current research activity is the theoretical study of the new and promising field of gravitational waves. To be specific I am focusing on the possibility of using them for cosmological purposes and to test modifications of the theory of General Relativity. Also, being member of the Observational Science Board, I am working on forecasting the capabilities of the Einstein Telescope. Moreover, I am an assistant, thus I am becoming much more proficient in teaching and understanding the other's various points of view. In 2022 I was awarded the Istituto Svizzero "Milano Calling" fellowship, which allowed me to visit the University of Milano-Bicocca from October 2022 to April 2023. During this experience I worked with the group of Prof. D. Gerosa, mainly focusing on Astrophysical aspects related to gravitational waves and data analysis.

2018–2020 **Master's Degree** in Astronomy and Astrophysics Sapienza University, Rome, Italy
General Relativity, Physical and Theoretical Cosmology, Stellar and High Energy Astrophysics, Relativistic Quantum Mechanics. Different topics linked to Astrophysics and High Energy Physics examined in-depth with particular focus on theoretical aspects of Gravity and Cosmology. In February 2019 I became part of the *Excellence Programme* and researched material linked to Inflation and Effective Field Theory under the supervision of Prof. F. Riccioni. I graduated with honors on October 1, 2020, writing my thesis under the supervision of Prof. M. Maggiore and Prof. A. Melchiorri about cosmological model testing via gravitational waves and galaxy clustering observation.

2015–2018 **Bachelor's Degree** in Physics Sapienza University, Rome, Italy
Classical, Statistical and Quantum Mechanics, Electromagnetism and Optics, Computational Physics, Statistics, Real, Complex and Functional Analysis. I learned the foundations of both theoretical and experimental physics, as well as the mathematics behind them. I graduated with honors on October 22, 2018, my thesis was about dark matter evidences from gravitational microlensing, the supervisor was Prof. P. de Bernardis.

Experience

2021–2024 **Teaching assistant** University of Geneva, Geneva, Switzerland
Since arriving in Geneva, I have been a teaching assistant for Thermodynamics, Mathematical Methods for Physics, and Electrodynamics II courses. This greatly improved my teaching and organisational skills and allowed me to understand better how to share my knowledge arousing interest in the students.

2022–2024 **Maturity exam jury member** Geneva, Switzerland

In 2022 (Collège de Saussure), 2023 (Collège Rousseau, Collège Sismondi, CEC André-Chavanne) and 2024 (Collège de Saussure, Collège Madame de Staël) I have been a jury member during the Swiss maturity exams, for the subjects of "Physics and Applications of Mathematics" and "Mathematics". As such, I participated in the correction of the written tests and oral examinations. This improved my ability in testing and evaluating students knowledge.

2019 **Collaboration Scholarship** Sapienza University, Rome, Italy

Organisational, teaching and problem solving skills. I set up instrumentation both for Mechanics, Thermodynamics and Electromagnetism Laboratory experimental classes and helped younger students during data taking and report writing.

Research interests

Einstein Telescope science

Einstein Telescope (ET) is the proposed European third-generation ground-based gravitational wave detector. As a member of the ET Observational Science Board, I extensively worked on different aspects of ET's science. In particular, together with the Geneva group, I developed `gwfast`, one of the few public Fisher-matrix codes capable of simulating how ET will reconstruct the parameters of the huge number of compact binary events it will detect. I am actively involved in the analysis and strengthening of the ET science case, in particular regarding compact binary mergers observation and prospects of their impact on astrophysics (e.g. compact objects populations), cosmology (e.g. primordial black holes) and fundamental physics (e.g. neutron star equation of state).

Gravitational-wave cosmology

Gravitational waves emitted by coalescing binary systems are ideal candidates to measure how the universe expands, giving direct access to the luminosity distance to the source. Also, gravitational waves could be the only way to test gravity models that modify GR on cosmological scales. I have worked on different ways of extracting cosmological information from GW events (e.g. correlating GWs and galaxy catalogs) and to test modified propagation (e.g. from quadruply lensed gravitational-wave events), and keep working on extending previous analyses, as well as in finding new ways to observe deviations from GR.

Multimessenger astrophysics

Gravitational wave signals emitted by the coalescence of two objects, if there is at least a neutron star, can trigger a burst of electromagnetic radiation. From the combination of the two observables we can better constrain e.g. the neutron star structure, the physical processes giving rise to the observed electromagnetic emission or the expansion history of the Universe. I have worked on the prospects of using joint gamma-ray burst polarimetry and GW measurements to obtain constraints on the burst emission model and, more recently, I am working with a group of leading experts to forecast the prospects of observing electromagnetic counterparts from neutron star-black hole coalescences both at current and future detectors.