

Viviana Fafone – Curriculum Vitae

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Positions

- 1994-2005 Researcher at the Frascati National Laboratories of the National Institute of Nuclear Physics (INFN)
- 2005-2017 Associate Professor of Astronomy and Astrophysics at the University of Rome Tor Vergata
- 2017-now Full Professor of Physics at the University of Rome Tor Vergata

Research

Main research interests: gravitation and gravitational wave (GW) physics, with a focus on Instrument Science developments.

Major involvements:

- cryogenic GW detectors **Explorer** (CERN), **Nautilus** (INFN Frascati Labs) and **MiniGRAIL** (Leiden University) (1992-2016). Development of quantum technologies (3He-4He dilution refrigerators and superconducting electronics - dc SQUID); acoustic and seismic noise reduction (the technology developed has also been applied in bolometers for γ - and α -ray spectroscopy at INFN Gran Sasso National Laboratories (LNGS) to reduce vibration and thermal noise); study of the properties of new generation spherical GW detectors; study of signals from astrophysical sources of GWs in different theories of gravitation (e.g. scalar-tensor theories); study of correlations of GW data with gamma-ray burst; study of the effects of cosmic rays and charged particle beams in acoustic detectors.
Most of the technologies developed in this framework have been synergistic for the success of present GW detectors and are contributing to the development of future GW observatories.
- Interferometric GW detector **Virgo** (European Gravitational Observatory - Cascina - Pisa) since 2006. Development of adaptive optics systems for the Virgo and Advanced Virgo projects, aimed at mitigating optical defects in the interferometer mirrors (essential to allow high power operation – 1.5 MW planned for Virgo future upgrades); studies on quantum noise reduction through the injection of squeezed vacuum states and investigation of new materials for mirrors' coatings. Contributions in multimessenger (MM) astrophysics (GWs-Low Energy Neutrinos, more recently GWs-GRBs).
- Next generation GW detector **Einstein Telescope (ET)** since 2008: among the authors of the first ET Design Study. Development of new strategies to reach the goal of 3 MW circulating power in the interferometer arm cavities; study of new materials for ET mirrors. These are crucial ingredients for reaching the planned factor of 10 improvement in the sensitivity of next-generation observatories that will have a transformative impact on the nascent field of GW physics and astronomy by leading us into the era of precision GW and MM astrophysics.
- Participation in the **Large-Scale Polarization Explorer** project for the detection of B-modes in CMB, a signature of primordial GW background, since 2015.
- Collaborations with research groups in many international institutions (e.g. CERN, Leiden University - The Netherlands, California Institute of Technology - USA, Adelaide University - Australia, Max Planck Institute Hannover - Germany, INFN Gran Sasso National Laboratories - Italy, NIKHEF - The Netherlands, Laboratoire des Matériaux Avancés Lyon - France).

Institutional Offices in Universities and Research Institutions

- 2008-2012: Member of the Teaching Board of the Ph.D. course in Astronomy at the University of Rome Tor Vergata
- 2008-2011: National contact person of INFN for the ET Design Study, European Commission FP7 (Grant Agreement 211743) and member of the ET Governing Council. Member of the writing team of the ET Design Study
- 2012: referee for the ETRUSCO-GMES experiment based on satellite laser ranging funded by INFN Scientific Committee V (for technological and interdisciplinary research)
- 2013 - now: Member of the Teaching Board of the joint Ph.D. in Astronomy, Astrophysics and Space Science of the Universities of Rome Tor Vergata, Sapienza, and INAF
- 2011-2019: Local coordinator, Academic Advisor, and member of the Selection Committee of the Erasmus Mundus Master Program "AstroMundus, International Master's Degree in Astronomy and Astrophysics" funded by the European Union
- 2013-2021: Delegate of the Faculty of Science in the Tor Vergata University Board for Learning, Orientation and Tutoring
- 2015-2017: Invited member of the Tor Vergata University Board for the International Relations and Cooperation
- 2015-2018: Member of the Tor Vergata Physics Department Executive Board
- 2021 - now: Member of the Board of Directors of the Tor Vergata Foundation aimed to mediate and aggregate between the University's Departments and the economic, social, and civil context, to promote culture, innovation, and regional development
- 2022 - now: Chair of the Quality Evaluation Committee of the Erasmus Mundus joint Master degree MASS (Master in Astrophysics and Space Science)
- 2022 - now: Member of the Evaluation Committee of the Gran Sasso Science Institute (GSSI)
- 2023 - now: INFN representative together with INFN Vice-President Prof. Marco Pallavicini in the INFN-INGV (National Institute of Geophysics and Volcanology) Joint Committee

Institutional Offices in Research Collaborations

- 1997-2006: Scientific Coordinator of the Gravitational Wave detector Nautilus at the INFN Frascati National Laboratories
- 2004-2006: Coordinator of the Gravitational Wave research group at INFN Frascati National Laboratories
- 2006 - now: Leader of the Virgo Tor Vergata group and member of the Virgo Steering Committee
- 2008-2016: Manager of the Advanced Virgo Thermal Compensation System for the mitigation of optical defects in the interferometer mirrors, a key component that allowed Virgo to reach its planned sensitivity for the observational runs O2 and O3
- 2016-2019: Manager of the Thermal Compensation System group for the Advanced Virgo commissioning
- 2017-2023: Co-chair of the Virgo Collaboration Editorial Board
- 2018 - now: National Representative of the Virgo experiment
- 2019-2022: Manager of the Advanced Virgo+ Thermal Compensation System
- 2019-2022: Member of the Einstein Telescope Steering Committee
- 2019-now: Member of the “Einstein Telescope Pathfinder” Scientific and Technical Advisory Committee
- 2020-2023: Member of the Virgo re-organization Committee (12 members out of about 850 members of the Virgo Collaboration)
- 2021-2022: Chair of the Virgo Committee appointed to draw the roadmap for the future of Virgo in the 2030-2040 decade
- 2022 - now: Coordinator of Virgo_nEXT Project, the proposed Virgo upgrade in the 2030-2040 decade
- 2022 - now: Leader of the ET Tor Vergata group and member of the ET Collaboration Board
- 2023 - now: Member of the Joint EGO-Virgo Committee charged with managing issues on financial matters
- 2024 - now: Member of the ET Collaboration Bylaws Updating Committee (8 members out of about 1600 members of the ET Collaboration)
- 2024 - now: Member of the IGWN (International Gravitational Wave Network) Design Committee. IGWN is a proposed single organization to coordinate the development, commissioning, and operations of the international network of ground-based GW detectors and to carry out the scientific mission of that network. The Committee is charged with developing a Charter and Bylaws for the organization (about 9 members from each of the LIGO, Virgo and KAGRA Collaborations)

Competitive Projects

- 2008-2010 Coordinator of the Tor Vergata University research unit for the project “Study of experimental issues in cryogenic and underground GW interferometers” funded by the Italian Ministry for Education, University and Research (MIUR - PRIN Research Program 2007)
- 2019-2024 PI of the project “ENIGMA: ENabling technologies for the upgrades of second generation and for third generation ground-based Interferometric Gravitational wave detectors in the medium- and high-frequency range: the keystone to foster Multimessenger Astronomy”, funded by MIUR - PRIN Research Program 2017
- 2020-2024 Coordinator of the Tor Vergata University research unit for the project AHEAD2020 (Integrated Activities for the High Energy Astrophysics Domain) - H2020-INFRAIA-2019-1
- 2022 - now: Partner Investigator of the ARC Centre of Excellence for GW Discovery (OzGrav) (PI Prof M. Bailes) funded by the Australian Research Council
- 2023 - now: PI for the Tor Vergata unit of the project ETIC (Einstein Telescope Infrastructure Consortium) funded by in the framework of the National Recovery and Resilience Plan (PNRR - Research Infrastructures)

Awards

- 1993: Winner of the Italian Physical Society Prize for young researchers
- 2002: Winner of the Italian Society of General Relativity and Gravitational Physics prize “for the contribution given to the field of Relativity and Gravitation on the experiments with resonant detectors and to the studies, both experimental and theoretical, on new generation gravitational waves detectors”. Selection Committee: C. Bachas (Ecole Normale Supérieure, Paris), M. Cerdonio (Università di Padova), G. Ellis (Cape Town, South Africa), B. Schutz (Albert Einstein Institute, Potsdam), G. Veneziano (CERN)
- 2016: Special Breakthrough Prize in Fundamental Physics, shared with the authors of the GW discovery paper
- 2016: Gruber Cosmology Prize, with the LIGO Scientific Collaboration and the Virgo Collaboration
- 2017: Albert Einstein Medal with the LIGO Scientific Collaboration and the Virgo Collaboration

Commissions of Trust

- 2010: Chair of the Selection Committee for the GWIC (Gravitational Wave International Committee) - Braccini Thesis Prize, the main recognition for Ph.D. theses in the field of GWs
- 2019 - now: Member of the GWIC - Braccini Ph.D. Thesis Prize Board
- 2019: Member of the Selection Committee for the INFN “Bruno Rossi” Ph.D. Thesis Prize
- 2021 Member of the Selection Committee for the Guido Horn D’Arturo Prize of the Italian Astronomical Society
- Referee for international journals

Teaching activity

At the Physics Department of the University of Rome Tor Vergata

- AY 2006/2007 - AY 2016/2017: General Physics – Electromagnetism and Optics (Bachelor's in science and technology for Media)
- AY 2007/2008 - now: Gravitational Waves (Master's degree in physics) the first master course specific on GWs in Italy
- AY 2016/2017 - now: General Physics – Mechanics and Thermodynamics (Bachelor's in physics)
- Lectures on General Relativity and Gravitational Waves for Ph.D. programs in Physics and in Astronomy and Astrophysics.

At the Gran Sasso Science Institute

- Lectures on Gravitational Wave sources and experiments from 2013 to 2021 for the Ph.D. in Astroparticle Physics
- Tutor for 10 Bachelor, 23 Master and 12 Ph.D. theses. Advisor for several post-doc researchers (12).

Conferences

- Member of the LOC of EWASS 2012 (European Week of Astronomy and Space Science), July 1-6, 2012 (Rome)
- Convener of the session "Q&A: Everything you wanted to know about GWs but were afraid to ask" at the 20th International Conference on General Relativity and Gravitation and 10th Amaldi Conference on Gravitational Waves, July 7-13, 2013 (Warsaw)
- Member of the Scientific Advisory Committee of GWADW 2015 (Gravitational Wave Advanced Detectors Workshop), May 17-22, 2015 (Girdwood, Alaska)
- Convener of the session on Gravitational Waves of TAUP 2015 (Topics in Astroparticle and Underground Physics), September 7-11, 2015 (Turin)
- Convener of the session on Gravitational Waves at RICAP-16 (6th Roma International Conference on Astroparticle Physics) June 21-24, 2016
- Member of the SOC of the LXII Italian Astronomical Society Conference, May 2-5, 2018 (Teramo, Italy).
- Convener of the session "Second Generation Interferometer Commissioning", GWADW 2019, May 19-25, 2019 (Isola d'Elba, Italy)
- Member of the SOC of the 2nd GRAvitational – wave Science&technology Symposium (GRASS 2019), October 17-18, 2019 (Padova, Italy)
- Convener of the session "Beyond Second Generation" at the GWADW 2021, May 17-21, 2021, remote
- Member of the International Advisory Committee at GWADW 2023, May 21-27, 2023 (Isola d'Elba, Italy)
- Member of the SOC of COSPAR-2024-E1.6 "Explosive Phenomena in Transient and Multimessenger Sources and Their Observational Manifestations", July 13-21, 2024 (Busan, Korea)
- Convener of the session on Gravitational Waves Detection at RICAP-2024, September 23-27, 2024

Delivered invited talks at numerous international conferences, with an average rate of a maximum of a couple per year (a fraction of invitations received, to prioritize opportunities for younger researchers).

Publications

- Author of more than 320 peer-reviewed publications in international journals. h-index: 96 (Scopus)
- Books:
 - "Gravitational Physics: from Quantum to Waves" in Multiple Messengers and Challenges in Astroparticle Physics, 357-488, Springer International Publishing Switzerland, 2018, ISBN: 978-3-319-65423-2, 978-3-030-09739-4, 978-3-319-65425-6
 - "Thermal Adaptive Optics" in Advanced Interferometric Gravitational Wave Detectors, World Scientific, 2019, ISBN: 978-981-314-607-5
 - "Optical aberrations in gravitational wave detectors and a look at the future" in Gravitational Waves and Cosmology, Proceedings of the International School of Physics Enrico Fermi 200, 69-86, IOS Press, 2020, ISBN: 978-1-64368-094-1

Public Lectures, outreach, etc:

- Participation in national and international outreach activities, with public talks, theater events, TV broadcasts, interviews for newspapers, social media to spread STEM disciplines through new generations, with a special focus on women in science (e.g.: Genoa Science Festival, European Researchers' Night, National Geographic Festival of Rome, Galassica - Astronomy Festival, St. Petersburg Science Festival, TEDx, RaiPlay - Discovering the Secrets of Space, Rai Scuola –Science Stories, Rai Cultura, Focus TV, Rai3-TG Leonardo, Rai1 – UnoMattina)
- Dissemination and training activities for students of primary and secondary schools, with seminars at schools and social events (e.g.: Campus Party - Fiera Milano, Student Fair in Rome, International Day of Women and Girls in Science, INFN International School on Modern Physics)
- Training courses for secondary school teachers on Modern Physics topics (e.g.: "Incontri di Fisica" – INFN Frascati National Laboratories)
- Author of the section "Gravitational Waves" of the X Appendix of the Italian Encyclopedia of Science, Literature and Arts, Treccani, 2020
- Author of the section "Multimessenger Astronomy" of the XI Appendix of the Italian Encyclopedia of Science, Literature and Arts, to be published in 2025 to celebrate the centenary of the founding of the Treccani Institute, and scientific coordinator of the Astronomy and Astrophysics lemmas.
- 2023 - now: Member of the scientific committee of "Asimmetrie" the INFN scientific popularization magazine.