

# Viviana Fafone - Curriculum Vitae

PERSONAL INFORMATION Viviana Fafone

## POSITIONS

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2017 - today **Full Professor (Physics)**  
University of Rome Tor Vergata, Physics Department

2005 - 2017 **Associate Professor (Astronomy and Astrophysics)**  
University of Rome Tor Vergata, Physics Department

- Courses taught:
  - Academic Year 2016/2017 - today: General Physics – Mechanics and Thermodynamics (Bachelor Degree)
  - Academic Year 2007/2008 - today: Gravitational Waves (Master Degree)
  - Academic Year 2006/2007 - Academic Year 2016/2017: Electromagnetism and Optics (Bachelor Degree)
- Tutor for many Bachelor, Master and Ph.D. students

1994 - 2005 **Researcher**  
INFN, Roma Tor Vergata and Frascati National Laboratories

## EDUCATION AND TRAINING

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1992-1994 **Training experience**  
Fellowships from CNR, INFN Roma Tor Vergata and INFN Frascati National Laboratories

1991 **Laurea Degree in Physics**  
University of Rome Tor Vergata, Physics Department, 110/110 cum laude

## SCIENTIFIC AND COORDINATION RESPONSIBILITIES

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### Institutional Offices in Universities and Research Institutions

- INFN National Representative of the Virgo Collaboration (2018 - today)
- INFN representative (together with Prof. Marco Pallavicini) in the joint INFN-INGV Committee (2023 – today)
- Member of the Administration Board of the Fondazione Universitaria CEIS – Economics – Tor Vergata (2021 - today)
- Member of the Tor Vergata Physics Department Executive Board (2015 - 2018)
- Member of the Teaching Board of the joint Ph.D. course in Astronomy, Astrophysics and Space Science - University of Rome Tor Vergata, Sapienza University of Rome and National Institute of Astrophysics (INAF) - (2013 - today)
- Delegate of the Faculty of Science in the Tor Vergata University Board for Learning, Orientation and Tutoring (2013 - 2021)
- 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” (2011 - 2019)
- Member of the Teaching Board of the PhD course in Astronomy (2008 - 2012)

### Institutional Offices in Research Collaborations

- Virgo\_nEXT Design Team Coordinator (2023-now)
- Co-chair of the Virgo Post-O5 Committee (2021 - 2023) for the definition of the Virgo roadmap in the decade 2025-2035
- Member of the Virgo Organization Committee (2020-2023) for the definition of the new Virgo bylaws
- Member of the Einstein Telescope Collaboration Board (2022 – now)
- Member of the Einstein Telescope Pathfinder Scientific and Technical Advisory Committee (2019 - today)
- Manager of the Advanced Virgo+ Adaptive Optics System (2019 - 2022)
- Member of the Einstein Telescope Steering Committee (2019 - 2022)
- Co-chair of the Virgo Editorial and Speakers Board (2017 - 2023)
- Manager of the Advanced Virgo Adaptive Optics System (2008 - 2016)
- Member of the ET Governing Council. Member of the writing team of the ET Design Study (2008 - 2011)
- Team leader of the Virgo Tor Vergata group and member of the Virgo Steering Committee (2006 - today)
- Local coordinator of the ROG (Ricerca Onde Gravitazionali – Gravitational Wave research) group (2004 - 2006)
- Coordinator of the gravitational wave detector Nautilus at INFN Frascati National Laboratories (1997 - 2006)

### Competitive Projects

- P.I. for the Tor Vergata unit of the PNRR project ETIC – Einstein Telescope Infrastructure Consortium (2023 – now)
- Partner Investigator in the project for the “AUSTRALIAN RESEARCH COUNCIL Centre of Excellence for Gravitational Wave Discovery” (P.I. Prof. M. Bailes) (2022 - now)
- Local responsible for the project AHEAD2020 (Integrated Activities for the High Energy Astrophysics Domain) - H2020-INFRAIA-2019-1 (2020 - today)
- Principal Investigator 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” (PRIN Research Program 2017) (2019 - 2023)
- Coordinator of the Tor Vergata University research unit for the project “Studio di problematiche sperimentali degli interferometri per onde gravitazionali criogenici e sotterranei” (PRIN Research Program 2007) (2008 - 2010)
- INFN national contact person for the ET Design Study, European Commission FP7 (Grant Agreement 211743) (2008 - 2011)

## RESEARCH FIELDS

- Research interests are in the field of gravitation, with main focus on gravitational wave physics (sources and detectors) and CMB.
- Major involvements:
  - cryogenic gravitational wave detectors Explorer (CERN) and Nautilus (INFN Frascati Labs) (1992-2016). Development of quantum technologies for the reduction of thermal and electronic noise with  $^3\text{He}$ - $^4\text{He}$  dilution refrigerators and superconducting electronic devices (dc SQUID); acoustic and seismic noise reduction in gravitational detectors; study of signals from astrophysical sources of gravitational waves in different theories of gravitation (e.g. scalar-tensor theories); study of the properties of spherical gravitational wave detectors; study of correlations of gravitational data with GRB detectors and neutrino detectors; study of the effects of cosmic rays and charged particle beams in acoustic detectors.
  - Interferometric gravitational wave detector Virgo (European Gravitational Observatory - Cascina - Pisa) since 2006. Main scientific activities: development of adaptive optics systems for the Virgo and Advanced Virgo projects. Contributions: studies on quantum noise reduction through the injection of squeezed vacuum states, Multimessenger Astronomy (GW-LEN, GW-GRBs).
  - Next generation gravitational wave detector Einstein Telescope since 2008: participation in the Design Study, contribution to the development of the adaptive optics system

- Collaboration with the Large-Scale Polarization Explorer project for detection of B-modes in CMB (2015-2023).
- Participation in the AdCoat INFN project on new coatings and materials for interferometric detectors in 2014-2015.
- Collaborations with research groups in many international institutions, such as CERN, Leiden University (Netherlands), California Institute of Technology (USA), Adelaide University (Australia).
- Scientific funds raised/managed: about 10 M€

## PUBLICATIONS - CONFERENCES

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### Publications

Over 350 peer-reviewed publications on international journals. H-index 82 (WOS)

Books:

- “Thermal Adaptive Optics” in *Advanced Interferometric Gravitational Wave Detectors*, World Scientific, 2019
- “Gravitational Physics: from Quantum to Waves” in *Multiple Messengers and Challenges in Astroparticle Physics*, Springer International Publishing Switzerland, 2018

### Conferences

Invited speaker in national and international conferences and workshops.

Organization of scientific meetings:

- TAUP 2023 (International Conference on Topics in Astroparticle and Underground Physics), August 28 - September 1, 2023, Vienna (Austria) - Convener of the session “Gravitational Waves”
- GDADW 2021 (Gravitational Wave Advanced Detectors Workshop), May 17-21, 2021, remote – Convener of the session “Beyond Second Generation”
- 2<sup>nd</sup> GRAvitational – wave Science&technology Symposium (GRASS 2019), October 17-18, 2019 (Padova, Italy) – Member of the Scientific Advisory Committee
- GDADW 2019 (Gravitational Wave Advanced Detectors Workshop), May 19-25, 2019, Isola d’Elba (Italy) – Convener of the session “Second Generation Interferometer Commissioning”
- LXII Conference of the Italian Astronomical Society, May 2-5, 2018, Teramo (Italy) - Member of the Scientific Organizing Committee
- RICAP-16 (6<sup>th</sup> Roma International Conference on AstroParticle Physics) June 21-24, 2016, Rome - Convener of the session “Gravitational Waves”
- TAUP 2015 (International Conference on Topics in Astroparticle and Underground Physics), September 7-11, 2015, Turin (Italy) - Convener of the session “Gravitational Waves”
- GDADW 2015 (Gravitational Wave Advanced Detectors Workshop), May 17-22, 2015, Girdwood (Alaska) - Member of the Scientific Advisory Committee
- 20<sup>th</sup> International Conference on general Relativity and Gravitation e 10<sup>th</sup> Amaldi Conference on Gravitational Waves, July 7-13, 2013, Warsaw - Convener of the session “Q&A: Everything you wanted to know about GWs but were afraid to ask”.
- EWASS 2012 (European Week of Astronomy and Space Science) July 1-6, 2012, Rome - Member of the Local Organizing Committee

## ADDITIONAL INFORMATION

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### Awards

- 2017: Albert Einstein Medal with the LIGO Scientific Collaboration and the Virgo Collaboration
- 2016: Special Breakthrough Prize in Fundamental Physics, with the LIGO Scientific Collaboration and the Virgo Collaboration
- 2016: Gruber Cosmology Prize, with the LIGO Scientific Collaboration and the Virgo Collaboration
- 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)
- 1993: Winner of the Italian Physical Society Prize for young researchers

### Commissions of Trust

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

### Outreach

- Participation in national and international outreach activities, with public talks, theater events, TV broadcasts, interviews for newspapers, social media (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)
- Participation in dissemination and training activities for students of primary and secondary schools, with seminars at schools and social events (e.g.: Campus Party - Fiera Milano, Salone dello Studente in Rome, International Day of Women and Girls in Science, International School on Modern Physics and Research – INFN, INSPYRE – Frascati National Laboratories))
- 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 Appendice dell’Enciclopedia Italiana, Treccani, 2020

Rome, February 27<sup>th</sup>, 2024

Viviana Fafone

September 2023

**GIACOMO CIANI**

*CURRICULUM VITAE*

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## CONTACT INFORMATION

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## EDUCATION

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### **PhD in Physics, University of Trento**

**2004 – 2007**

*Advisors:* prof. Stefano Vitale, prof. Rita Dolesi

*Thesis Title:* “Free-fall of LISA Test Masses: a new torsion pendulum facility to test linear motion” (defense date: February 21, 2008)

*Grade:* excellent

*Main activity:* design and construction of a torsion pendulum facility for characterizing LTP/LISA capacitive inertial sensor force noise disturbances on linear degrees of freedom at the femto-Newton level.

### **2<sup>nd</sup> level (1<sup>st</sup> level + 2 years) degree in Applied Physics, Univ. of Pisa**

**2002 – 2004**

*Advisor:* prof. Valeria Rosso

*Thesis Title:* “Studio e ottimizzazione di alcuni parametri nella radiografia a doppia energia” (“Study and optimization of some parameters in Dual Energy radiography”)

*Grade:* 110/110 with special commendation (magna cum laude)

### **1<sup>st</sup> level (3 years) degree in Physics, University of Pisa**

**1998 – 2002**

*Advisor:* dr. Maurizio Varanini

*Thesis Title:* “Un metodo per l’analisi spettrale tempo-frequenza a risoluzione variabile” (“A method for variable resolution time-frequency spectral analysis”), at “Clinical Physiology Institute”, C.N.R. of Pisa.

*Grade:* 110/110 with special commendation (magna cum laude)

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## APPOINTMENTS

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### **Associate professor, University of Padova**

**2020 – Present**

*Main activities:* Advanced Virgo and Advanced Virgo Plus vacuum squeezing injection, mode matching and stray light suppression. Thermal noise in mechanical systems out of equilibrium. R&D for present and future ground-based gravitational wave detectors, including Einstein Telescope.

- Researcher (RTDB, tenure track), University of Padova** **2017 – 2020**  
*Main activities:* Advanced Virgo and Advanced Virgo Plus vacuum squeezing injection and mode matching. R&D for present and future ground-based gravitational wave detectors, including Einstein Telescope.
- Assistant scientist, University of Florida** **2012 – 2017**  
*Main activities:* Advanced LIGO Input Optics and Thermal Compensation System R&D for ground and space-based gravitational wave detectors
- Postdoctoral scholar, University of Florida** **2009 – 2012**  
 Research group: LIGO  
*Supervisors:* prof. David Reitze, prof. David Tanner, prof. Guido Mueller  
*Main activities:* Advanced LIGO input Optics and Thermal Compensation System. R&D for next generation gravitational waves detectors.
- Postdoctoral scholar, University of Trento** **2008 – 2009**  
*Research group:* Low temperature and Experimental Gravitation Laboratory  
*Supervisors:* prof. Stefano Vitale, prof. Rita Dolesi, prof. William J Weber  
*Main activity:* development and ground testing of the LISA/LISA Pathfinder Gravity Reference Sensor and associated noise model.
- Scientific software developer at “Clinical Physiology Institute”, C.N.R. of Pisa** **2003**  
*Supervisor:* dr. Fabrizio Conforti  
*Main activity:* Development of algorithms for biological signal analysis, visualization and managing and their implementation using Java and XML technologies.

## **FUNDING AND SCIENTIFIC RESPONSIBILITIES**

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- Local (UniPD) PI of the EINSTEIN TELESCOPE INFRASTRUCTURE CONSORTIUM (ETIC) project funded under Italian PNRR initiative**  
**2022 – present**  
 Responsible for the construction of CoMET (Coating Materials for ET), a 3M euros laboratory for research on GW detectors optical coatings
- Leader of the Padova Einstein Telescope (ET) Research Unit** **2022 – present**
- Co-Chair of the Squeezed-Light Work Package of the ET project** **2020 – present**
- Research fellow (“incarico di ricerca”) at INFN Padova section** **2018 – present**
- PI of funded proposal for a 2-year research project (UniPD BIRD call)** **2019 – 2021**  
 “Thermal Noise in Solids in Non-Equilibrium Steady States”
- Internal reviewer for Advance Virgo Plus Large Payloads subsystem** **2019**
- Co-responsible for mode-matching sensing hardware and strategies for Advanced Virgo Plus frequency-dependent vacuum squeezing injection** **2019**
- PI of funded proposal for a postdoctoral position (UniPD BIRD call)** **2017 – 2019**  
 “Quantum noise reduction in the Advanced VIRGO gravitational wave detector”

<b>Recipient of Ministry of Education “Annual support for basic research activities for individuals” (FFABR)</b>	<b>2017</b>
<b>Courtesy Assistant Scientist, Department of Physics, University of Florida</b>	<b>2017 – 2022</b>
<b>Co-investigator of funded NASA APRA proposal 13-APRA13-0046: “Optical Bench for LISA-like missions”</b>	<b>2014 – 2017</b>
<b>Coordinator of the production, testing and quality assurance of the Advanced LIGO Ring Heaters</b>	<b>2011 – 2013</b>
<b>Responsible of the design, building, installation and testing of the Advanced LIGO input optics mechanical suspensions</b>	<b>2009 – 2012</b>
<b>Major responsibilities in the ground-based test campaign of the LISA Pathfinder inertial reference sensor</b>	<b>2007 – 2009</b>

**SUPERVISOR ACTIVITY**

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**Postdocs, fellows and technicians**

*2023-present*

*2023-present*

*2020-2021*

**PhD Students:**

*2022 – present*

*2020 – present*

*2020 – present*

**Master thesis**

*Ongoing*

*Ongoing*

*2022*

**Undergraduate thesis****TEACHING ACTIVITIES**

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**Local host, point of contact and supervisor for the NSF's *International Research Experience for Undergraduates* program** **2018 – Present**

**Professor, University of Padua** **2017 – Present**

- “Gravitational Physics” (Master in physics)
- “Advanced Optics and metrology” (Master in Physics)
- “Gravitational Waves: a new instrument to observe the universe” (PhD in Astronomy)
- “Physics with elements of mathematics” (Corso di Laurea a ciclo unico in Farmacia)

**Participated in the “Teaching4Learning - Advanced” training course on innovative teaching organized by the University of Padova (bestr badge earned)** **2021**

**Participated in the “Teaching4Learning” training course on innovative teaching organized by the University of Padova (bestr badge earned)** **2019**

**Lecturer, SBH2018 PhD summer school: “Black Holes and their Host Galaxies”** **2018**

**Volunteer science teacher for low-income citizens** **2014 – 2016**

- Taught science class at the high-school level for adult students
- Preparation for GED exam

**Judge for the Alachua County Regional Science and Engineering Fair** **2011 – 2017**

**Teaching assistant, University of Trento** **2008 and 2009**

- First year physics course for engineers
- Prepared the course, taught and graded exams for a class of about 100 students

**Teaching assistant, University of Trento** **2006**

- First year laboratory course for physicists
- Supervised laboratory work with 2 classes of about 20 students



## **INSTITUTIONAL RESPONSIBILITIES**

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**Member of the “Ecological transition committee” of the Department of Physics and Astronomy**  
*2021 – present*

**Member of the “Admission test committee” of the UniPD School of Science** *2020 – present*

## **MEMBERSHIPS AND OTHER SCIENTIFIC ACTIVITIES**

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**“Abilitazione Scientifica Nazionale a professore di II fascia” (National Scientific Abilitation as associate professor)** *2018 - 2024*

**Editor and referee of the proceedings of the GRAvitational-waves Science&technology Symposium (GRASS)** *2018, 2019, 2022*

**Member of the Scientific Advisory Committee and Local Organizing Committee of the GRAvitational-waves Science&technology Symposium (GRASS)** *2018, 2019, 2022*  
Padova, Italy

**Member of the Einstein Telescope scientific collaboration** *2022 – present*

**Member of the VIRGO scientific collaboration** *2017 – present*

**Member of the Scientific Organizing Committee of the SBH2018 PhD summer school: “Black Holes and their Host Galaxies”** *2018*  
Asiago Astrophysical Observatory, Asiago (VI), Italy

**Member of the American Physical Society (Division of Gravitational Physics)** *2014 – 2018*

**Member of the LIGO Scientific Collaboration** *2009 – 2017*

**Member of the Local Organizing Committee of the LISA Symposium X** *2014*  
University of Florida, Gainesville, Florida (USA)

**Editor and referee of the proceedings of the LISA Symposium X** *2014*

### **Ongoing referee activity:**

- Applied Physics Letters *since 2022*
- Journal of Optics *since 2022*
- Measurement Science and Technology *since 2022*
- Review of Scientific Instruments *since 2020*
- Journal of Optics and Laser Technology *since 2018*
- ERC starting grants *since 2018*
- NASA Postdoctoral Program *since 2016*
- Classical and Quantum Gravity *since 2012*

## **PRIZES AND AWARDS**

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<b>IOP Outstanding reviewer award for Measurement Science and Technology</b>	<b>2022</b>
<b>IOP Outstanding reviewer award for Classical and Quantum Gravity</b>	<b>2020</b>
<b>Albert Einstein Medal</b>	<b>2017</b>
<b>Bruno Rossi Prize</b>	<b>2017</b>
<b>Princess of Asturias Award for Technical and Scientific Research</b>	<b>2017</b>
<b>Royal Astronomical Society Group Achievement Award</b>	<b>2017</b>
<b>Gruber Cosmology prize</b>	<b>2016</b>
<b>Special Breakthrough Prize in Fundamental Physics</b>	<b>2016</b>

## **RESEARCH PROJECTS AND EXPERIENCE**

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- VIRGO and ET group, University of Padova and INFN Padova section** **2017 – Present**
- Participating in the integration and commissioning of the Advanced VIRGO detector, with emphasis on squeezed vacuum injection subsystem and stray light mitigation.
  - R&D activities for next generation gravitational wave detectors (in particular Einstein Telescope): coating, thermal noise, quantum noise, stray light.
  - Leading a research program on sensors and techniques for mode matching and alignment of optical cavities in interferometric gravitational wave detectors.
  - Conducting experimental research on thermal noise in steady state systems out of thermodynamic equilibrium.
  - Participation in the design of the frequency-dependent vacuum squeezing injection system for Advanced Virgo Plus, with direct responsibilities for mode-matching sensing hardware and strategies
  - Co-leader of a research plan for the measurement, modeling and mitigation of stray light effects in Advanced Virgo and Einstein Telescope, with particular emphasis on contributions from dust particulate.
- LISA group, University of Florida (in collaboration with MAE department)** **2012 – 2017**
- Led the construction and commissioning of a torsion pendulum facility for testing technologies related to the gravitational reference sensor for Earth geodesy and space-borne gravitational wave observatories. Coordinated the work of an interdisciplinary group of five PhD students and two undergraduate students from both the Physics and Mechanical and Aerospace Engineering departments.
  - Co-supervised a PhD student on the characterization of non-contact, UV-LED based charge management system for gravitational reference sensors, from the point of view of LED performance, effective material work function (and consequent photoemission quantum efficiency) and charge management strategy. Co-supervised an international visiting student in the development of a semi-analytical model to describe the charge-discharge dynamics in these systems.
  - Led a PhD student on a project to develop a high sensitivity and high dynamic range polarization-multiplexed interferometric readout for torsion pendulums. A working prototype has been integrated in the torsion pendulum facility mentioned above, improving readout noise by a factor  $\sim 50$ .

- Guided two PhD and one undergraduate student in research projects related to exploring alternative optical layouts and construction techniques of ultra-stable optical benches for space-based gravitational waves missions. Supervised an international visiting student in the setup of a system for the measurement of ultra-stable structures at the picometer level using heterodyne-interferometry.

#### **LIGO Group, University of Florida**

**2009 – 2017**

- Participated in the design, installation and commissioning of the Advanced LIGO Input Optics; spent extended periods of time working on the Advanced LIGO detectors at both the Hanford and Livingston sites.
- Led the development of the Advanced LIGO HAM Auxiliary Suspensions, from design, modeling and testing of the prototype to assembly, installation and commissioning of the final units; these suspensions provide vibration isolation to in-vacuum mirrors of the Advanced LIGO Input Optics.
- Participated in the development and characterization of parts of the Advanced LIGO Thermal Compensation System. Performed both analytical and FEA modeling of thermal effects in the Advanced LIGO optics and their impact on the interferometer operations; contributed to the design of the annular radiative thermal actuators for Advanced LIGO (ring heaters), and led the effort to optimize their performance; supervised an undergraduate student in the construction and testing, using a custom in-vacuum measuring apparatus, of the actuators which are currently in use in the Advanced LIGO interferometers. Led the development of an alternative ring heater design as a risk reduction activity (the new design is being considered by LIGO for integration in the next observing run).
- Contributed to the development of an astigmatic transmissive adaptive optical element based on thermal lensing. Led an international visiting student in the optimization of the design, which increased the thermal efficiency by a factor of about 5.
- Helped supervise two PhD students in the design and construction of two experiments for the measurement of coating Brownian thermal noise, employing ultra-stable reference cavities and digital phasemeter readout. Leading a third PhD student in the effort to measure coating Brownian thermal noise in the Advanced LIGO coatings.
- Led two undergraduate students in a project to model and simulate gravity gradient noise generated by a seismic field.

#### **Experimental Gravitation Group, University of Trento**

**2004 – 2009**

- Participated in the design and characterization of nm-level capacitive sensors.
- Designed, realized and operated a thermal-noise limited torsion pendulum apparatus for testing fN-level stray forces.
- Development and experimental investigation of noise models of fN-scale force disturbances in gravitational reference sensors for gravitational-wave space missions (LISA/LISA Pathfinder).
- Held major responsibilities in the ground-testing program of the Flight Model Replica (i.e. Qualification Model) of the LISA/LTP gravitational reference sensor, including setting up the experimental apparatus and procedures.
- Contributed to in the development of experimental techniques and data analysis procedures for the testing campaign and the gravitational reference sensor; many of these techniques became the base for the LISA Pathfinder experimental master plan.
- Contributed to the development and testing of a backup optical readout system for the LISA gravitational reference sensor in collaboration with the Napoli INFN group

**Medical Physics Group, University of Pisa****2003 – 2004**

- Worked at the optimization of both acquisition and analysis techniques for dual-energy radiography using MediPix single-photon matrix detector. This technique allows for images taken with x-ray beams of different energies to be combined in a synthetic image enhancing visibility of the tissue of interest
- Developed a custom software for dual-energy radiography image composition and analysis.

**Institute of Clinic Physiology, CNR (National Research Council) PISA section** **2003**

- Developed algorithms for biological signals spectral analysis with frequency dependent resolution.
- Developed Java- and XML-based software tools for spectral analysis, to be used in the clinical environment.

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**INVITED TALKS**

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**“Detecting Gravitational Waves”**

IAPS remote meeting on GW, remote

2020, Aug 26

**“The (glorious) past, (exciting) future and (foreseeable) future of gravitational wave detectors”**

Warsaw Spring Workshop, Jagiellonian University , remote

2020, May 25

**“Gravitational Wave astronomy with Virgo and the GW detectors network”**

NTIHEP 2018, Budva, Montenegro

2018, Sep 24

**“LISA Pathfinder: (free-)falling like never before”**

Seminar, University of Minnesota, Minneapolis, Minnesota, USA

2016, Apr 11

**“Advanced LIGO project status: getting ready to listen to the universe”**

CGC Conference Miami, Fort Lauderdale, Florida, USA

2014, Dec 17-23

**“Advanced LIGO and the 2<sup>nd</sup> generation of gravitational wave detectors”**

CGC Conference Miami, Fort Lauderdale, Florida, USA

2011, Dec 15-20

**“LISA – A space-borne gravitational wave observatory”**13<sup>th</sup> Summer Institute at LNGS, Gran Sasso National Labs, Italy

2008, Sep 22-Oct 8

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**CONTRIBUTED TALKS**

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**“Current status and goals of CoMET”**

XIII ET Symposium, Cagliari, Italy

2023, May 8-12

**“Measuring (excess?) thermal noise on a macroscopic oscillator in non-equilibrium conditions”**

GRAvitational-wave Science&amp;technology Symposium, Padova, Italy

2019, Oct 17-18

**“Fast cooling of interferometer payload”**

Kagra-Virgo-3G Workshop, Perugia, Italy

2019, Feb 14-16

**“CryoTHOR update”****“Low Loss Faraday Isolator for squeezing injection”**

LVC March Meeting, Pasadena, California, USA

2017, Mar 13-17

<b>“CryoTHOR: measuring Thermal Noise in Optical Coatings”</b>	APS April Meeting, Salt Lake City, Utah, USA	2016, Apr 16-19
<b>“Advanced LIGO Input Optics”</b>	50 <sup>th</sup> Rencontres de Moriond, La Thuile (AO), Italy	2015, Mar 21-28
<b>“UF Ring Heater Reloaded”</b>	LVC Meeting, Hannover, Germany	2013, Sep 23-27
<b>“HAM Aux status report”</b>	LVC Meeting, Rome, Italy	2012, Sep 10-14
<b>“HAM Auxiliary Suspensions assembly and testing status”</b>	LVC Meeting, Boston, Massachusetts, USA	2012, Mar 19-23
<b>“TCS Ring Heater status update”</b>	LVC Meeting, Gainesville, Florida, USA	2011, Sep 26-29
<b>“Measuring coating thermal noise in the LIGO band”</b>	GWADW, Isola d’Elba, Italy	2011, May 22-28
<b>“aLIGO TCS Ring Heater development at UF”</b>	LVC Meeting, Krakow, Poland	2010, Sep 20-24
<b>“LISA/LISA Pathfinder Gravity Reference Sensor”</b>	8 <sup>th</sup> Edoardo Amaldi Conference, New York City, New York, USA	2009, Jun 22-26
<b>“LISA/LISA Pathfinder Gravity Reference Sensor”</b>	7 <sup>th</sup> Edoardo Amaldi Conference, Sidney, Australia	2007, Jul 8-14

## **OUTREACH TALKS AND ACTIVITIES**

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<b>“Le onde gravitazionali investono Rovigo”</b>	Urban Digital Center, Rovigo, Italy	2023, Sep 12
<b>“Il vetro per ascoltare i sussurri dell’universo con le onde gravitazionali”</b>	Musei Ermitiani, Padova, Italy	2023, Feb 15
<b>“Onde gravitazionali: sussurri di giganti dalla profondità del cosmo”</b>	Liceo DaPonte, Bassano del Grappa, Italy	2019, Feb 9
<b>Coordinator of the Virgo360 project: a virtual visit of the Virgo Interferometer</b>		2021-2022
<b>Member of the Virgo outreach group</b>	<ul style="list-style-type: none"> <li>• Organization of outreach events and stands at “Notte della Ricerca” annual festival</li> <li>• Participation in a project to realize GW-related outreach material for vision-impaired people</li> </ul>	
<b>“Esplorando il Cosmo: infinito o infinitamente misterioso?”</b>	Liceo Maffei, Verona, Italy	2019, Apr 15
<b>Guest of a round-table on Gravitational-Wave Science</b>	European researcher’s night, Padova, Italy	2018, Sep 27

<b>“Storia di stelle, cataclismi e onde gravitazionali”</b>	ESTAGE program, Osservatorio della Specola, Padova, Italy	2018, Jun 18
<b>“La fucina d’oro cosmica: storia di stelle, cataclismi e onde gravitazionali”</b>	Pint of Science – Old England Pub, Padova, Italy	2018, May 15
<b>“Fabbriche d’oro e scontri fra titani: alla scoperta dell’universo con le onde gravitazionali”</b>	Public library, San Casciano in Val di Pesa (FI), Italy	2018, Apr 20
<b>Intervento sulla scienza delle onde gravitazionali</b>	AstrOdorzo, l’esplorazione dell’ignoto – Oderzo (TV), Italy	2018, Apr 05
<b>“Onde gravitazionali: la rivoluzione dell’astronomia tra tecnologia e scienza”</b>	Giornata Fermiana – Dep. of Physics and Astronomy, Padova, Italy	2018, Feb 08
<b>“Gravitational waves: listening to the whispers of the universe”</b>	Liceo scientifico Pesenti, Cascina (PI), Italy	2018, Feb 05
<b>“Onde gravitazionali: la rivoluzione dell’astronomia tra tecnologia e scienza”</b>	Liceo scientifico Enriques, Livorno, Italy	2017, Nov 22
<b>“GW170817: vibrazioni dello spazio-tempo”</b>	Palazzo Moroni, Padova, Italy	2017, Oct 19
<b>Organization of the Virgo Stand at the “Researcher’s night”</b>	Palazzo Bo, Padova, Italy	2017, Sep 29
<b>“La teoria della relatività di Einstein: da Galileo al GPS... e oltre!”</b>	Public library, San Casciano in Val di Pesa (FI), Italy	2017, May 23
<b>“Onde gravitazionali: quanto rumore!”</b>	Liceo scientifico Leonardo da Vinci, Firenze, Italy	2017, Apr 07
<b>“Onde gravitazionali: quanto rumore!”</b>	Public library, San Casciano in Val di Pesa (FI), Italy	2016, Mar 23
<b>“Catching the (gravitational) wave”</b>	Howard W Bishop Middle School, Gainesville, Florida, USA	2016, Mar 1

## **POSTERS**

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<b>“Dust in ET beampipes: contribution to noise and cleanliness requirements”</b>	XIII ET Symposium, Cagliari, Italy	2023, May 8-12
<b>“Characterizing dust contamination in AdVirgo”</b>		
<b>“Test of LG10 RF high order mode sensing technique for laser-cavity mode-matching”</b>	LVK Meeting, remote	2020, Sep 14-17
<b>“LG10 RF sideband injection for sensing cavity-laser mode-mismatch”</b>	GWADW, Isola d’Elba, Italy	2019, May 19-25
<b>“LISA Technology in new light”</b>		
<b>“Technology development for the LISA mission using the UF Torsion Pendulum”</b>	XXIX IAU General Assembly, Honolulu, Hawaii, USA	2015, Aug 3-14

- “The UF Torsion Pendulum, a LISA Technology Testbed: Sensing System and Initial Results”**  
**“UV-LED charge control for LISA”**  
**“Mechanical design of the University of Florida Torsion Pendulum for testing the LISA Gravitational Reference Sensor”**  
 10th International LISA Symposium, Gainesville, Florida, USA 2014, May 18-23
- “UV-LED-based charge control for LISA”**  
**“Mechanical design of the University of Florida Torsion Pendulum for testing the LISA Gravitational Reference Sensor”**  
 APS April Meeting, Savannah, Georgia, USA 2013, May 19-25
- “Active thermal lensing elements for spherical and astigmatic mode matching”**  
**“Novel alignment sensing scheme with RF jitter modulation”**  
 GWADW, Isola d’Elba, Italy 2013, May 19-25
- “RH production and testing”**  
 LVC Meeting, Bethesda, Maryland, USA 2013, Mar 18-22
- “TCS Ring Heater R&D at UF”**  
 LVC Meeting, Boston, Massachusetts, USA 2012, Mar 19-23
- “Thermal Compensation System Status for the aLIGO Auxiliary Optics system”**  
 LVC Meeting, Arcadia, California, USA 2011, Mar 14-17
- “HAM Auxiliary suspensions”**  
 LVC Meeting, Krakow, Poland 2010, Sep 20-24
- “An Optical Read-Out system for the Trento Four-mass Torsion Pendulum Facility”**  
**“Gas damping in the LISA noise budget”**  
 8<sup>th</sup> Edoardo Amaldi Conference, New York City, New York, USA 2009, Jun 22-26
- “An improved torsion pendulum for on-ground verification of the LISA Gravitational Reference Sensor”**  
**“First study of force noise with the LISA-Pathfinder Gravitational Reference Sensor with sapphire electrodes”**  
**“A 4-TestMass torsion pendulum for direct force measurements in preparation for LISA and LISA Pathfinder Gravitational Reference Sensor ground testing”**  
**“Testing the LTP Data Analysis environment with torsion pendulum data”**  
 7<sup>th</sup> International LISA Symposium, Barcelona, Spain 2008, Jun 16-20
- “Direct force characterization of the LISA Gravity Reference Sensor”**  
**“Ground testing of an Optical Read-Out for the LISA Gravitational Reference Sensor with a Four-mass Torsion Pendulum Facility”**  
**“Characterization of the LISA Gravitational Reference Sensor with an upgraded torsion pendulum”**  
 7<sup>th</sup> Edoardo Amaldi Conference, Sidney, Australia 2007, Jul 8-14
- “LTP Gravitational Reference Sensor characterization”**  
**“Development of a facility for direct force measurements of LISA Gravitational Reference Sensor related disturbances”**  
 6<sup>th</sup> International LISA Symposium, Greenbelt, Maryland, USA 2006, Jun 19-23



# GIANCARLO CELLA

Giancarlo Cella

## RESEARCH INTERESTS

I started my research activity in the field of theoretical high energy physics, working on radiative corrections to electroweak processes and lattice field theories. For a period of a few years following my PhD I dedicated myself to technological and activities, working on various projects within the P3C consortium of Pisa, characterized by the application of parallel numerical computation tools. Since 1996 my main interest is the study of gravitational waves as a member of the LIGO/Virgo/KAGRA collaboration. The LIGO/Virgo collaboration recently obtained the first direct detection of gravitational waves, the first evidence of a coalescence of two black holes, the first triple coincidence detection of a coalescence of two black holes and the first direct detection of a coalescence of two neutron stars. From 2019 to 2023 I coordinated Virgo's data analysis activities. Together with my counterparts from Virgo and KAGRA I coordinated in the same period the data analysis activities of the LIGO/Virgo/KAGRA collaboration.

- DATA ANALYSIS

- JOINT DATA ANALYSIS Before the first data taking of Virgo and LIGO I took care of the joint data analysis activities preparation, as a member of the appointed committee. This set the stage for the full collaboration between the two experiments, which continues today and has led to the complete sharing of data and scientific publications.
- STOCHASTIC BACKGROUNDS My main interest is the study of stochastic background of gravitational waves. I had for several years the responsibility of coordinating activities on this issue for Virgo, in the framework of the Virgo/LIGO collaboration. I wrote the first Virgo code for the search for stochastic backgrounds, which was tested and applied to real data.
- STOCHASTIC BACKGROUND UPPER LIMITS There is currently no evidence for stochastic backgrounds of gravitational wave in the data analyzed by the collaboration. Several phenomenological constraints on different cosmological and astrophysical modes have been obtained by the joint analysis group I coordinated. These are continuously improving, and the contribution of Virgo to this type of research is particularly significant in the high frequency area of the detection



band and in the search for anisotropies. The detections of gravitational waves from compact binary coalescences obtained by the LIGO/Virgo collaboration made possible to estimate that it may be possible soon to reveal the astrophysical stochastic background generated by kind of events.

- **HARDWARE INJECTIONS** The search for a stochastic background requires the contribution of several interferometers, and the time synchronization between these is an extremely important aspect of the experimental activity. To obtain it, simulated data is injected in "hardware" mode, i.e., by applying an appropriate signal to the mirrors of the cavities. The study of the result of this procedure allows to calibrate the signals and compensate for any delays. I was directly involved of the procedure of injection of stochastic signals, and of their analysis.
- **CONTINUOUS WAVES** I contributed to the detection of signals from continuous sources (pulsars), by developing and studying an innovative algorithm for the correction of the Doppler modulation caused by the motion of rotation and revolution of the earth.
- **DETECTOR NOISE STUDY** I implemented several algorithms for noise analysis within the Noise Analysis Package, a general library for data analysis I am one of the main developers of.
- **MULTIMESSENGER SEARCHES** I analyzed analytically and numerically (via Monte Carlo simulations) the prospects for joint Virgo/LIGO/CTA observations of gravitational waves and high energy electromagnetic signals.

- **ADVANCED DETECTORS**

- **MECHANICAL SIMULATIONS** I worked on mechanical simulation of seismic attenuation systems for gravitational wave detectors, both in Virgo and LIGO. I designed and implemented several techniques of modelization, and the mechanical part of the end-to-end detector simulation system for LIGO.
- **NEWTONIAN NOISE ESTIMATE** I worked out an analytical model that allows to obtain a prediction of Newtonian noise of a gravitational wave detector using seismic measurements.
- **NEWTONIAN NOISE MITIGATION** I proposed and elaborated the basic approach for the mitigation of Newtonian noise.
- **EINSTEIN TELESCOPE** I contributed to the ET design study giving estimates of Newtonian noise level in different scenarios, proposing mitigation methods, and evaluating their effectiveness.
- **QUANTUM NOISE** I studied the application of squeezing techniques to the quantum noise of gravitational waves' detectors.
- **RESIDUAL GAS NOISE** I elaborated a model, and I estimated the noise generated by residual gas in the optical cavities of gravitational waves' detectors.
- **THERMAL NOISE** I proposed techniques for the reduction of thermal noise generated by the coating of mirrors inside a gravitational waves' detectors.
- **GEOMETRIC ANTISPRINGS** I studied a solution for mechanical attenuation based completely on geometrical effects. This solution is currently implemented in second generation interferometric detectors of gravitational waves.
- **GINGER** Until 2015 I collaborated with the GINGER experiment, which aim to measure gravitomagnetic effects generated by the earth using an array of ring lasers in the Gran Sasso international laboratory (LNGS)

- **PHENOMENOLOGY**

- NON-STANDARD POLARIZATIONS I study detection methods and perspectives for stochastic backgrounds of gravitational waves with nonstandard polarization contents, foreseen by extended model of gravitation (models beyond general relativity).
- COSMIC STRINGS I study stochastic background of gravitational waves generated by network of cosmic strings.

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## POSITIONS

January 1, 2020-today	<b>Senior researcher (Primo Ricercatore)</b> Istituto Nazionale di Fisica Nucleare · Pisa Department
2008-December 31, 2019	<b>Permanent researcher</b> Istituto Nazionale di Fisica Nucleare · Pisa Department
2004-2008	<b>Temporary researcher</b> Istituto Nazionale di Fisica Nucleare · Pisa Department
2003	<b>Postdoc</b> Dipartimento di Fisica · Università di Pisa
2002	<b>Postdoc</b> Istituto Nazionale di Fisica Nucleare · Pisa Department
2001	<b>Postdoc</b> Dipartimento di Fisica · Università di Pisa
1997-1998	<b>Collaboration contract</b> California Institute of Technology · Pasadena CA – USA
1995	<b>Postdoc: application of parallel and distributed computing to scientific problems</b> Consorzio Pisa Ricerche · Pisa
1992-1994	<b>Postdoc</b> Dipartimento di Fisica · Università di Pisa
1991	<b>Civil service</b> .

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## EDUCATION

- |      |  |
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| 1995 | <b>PH. D. THESIS</b><br>Effetti di regolarizzazione in teorie di campo su reticolo. Correzioni QCD a processi di decadimento FCNC. (Regularization effects in lattice field theories, and QCD corrections to FCNC decay processes). · Dip. di Fisica dell'Università di Pisa, Supervisor: Prof. Giuseppe Curci |
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July 19 1990 **MASTER THESIS**  
Effetti di interazione forte nel decadimento debole del mesone B. (Strong interaction effects in weak B-meson decay). · Dipartimento di Fisica dell'Università di Pisa. Supervisor: Prof. Giuseppe Curci. 110/110 cum laude.

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## RESPONSIBILITIES

- 2019-2022 **Virgo data analysis coordinator.**  
Main responsibilities: coordination of Virgo data analysis activities, of scientific subgroups, joint coordination with LIGO and KAGRA chairs of data analysis activities of LIGO/Virgo/KAGRA collaboration. ·
- 2015-today **Virgo Steering Committee member**
- 2015-today **Virgo Pisa group coordinator**  
The group has key responsibilities in the Virgo collaboration: construction, commissioning (superattenuators, controls, electronics) and data analysis (stochastic backgrounds, continuous sources, compact binary coalescences, multimessenger). ·
- 2019-2021 **Pisa coordinator OLAGS project.**  
INFN project "Commissione Scientifica Nazionale 5": Optical Links for Atomic Gravity Sensors. Demonstrator for the possibility of gravitational gradient measurement with displaced sensors. ·
- 2009-today **INFN Pisa representative inside VESF Council**  
The VESF is the Virgo-EGO Scientific Forum. ·
- 2019-today **Director of physics school of the cultural association "Scholé"**
- 2016-2018 **INFN Pisa coordinator European Union project GraWIToN.**  
Initial Training Network, funded by European Commission under FP7-Marie Curie Actions · <http://www.grawiton-gw.eu/>
- 2015-2017 **Referee CALC\_TIER1, "Commissione Scientifica Nazionale 2" INFN.**
- 2004-2012 **Responsible hardware e software injections stochastic background in Virgo**
- 2002-2012 **LIGO/Virgo stochastic background search group chair**
- 2011 **Writing team member "Einstein Telescope Conceptual Design Document"**
- 2007 **Virgo Editorial Board member**
- 2000 **Member Joint LIGO/Virgo data analysis preparation committee**

## EVALUATOR

2015-2019 **ANVUR evaluator VQR**

## OTHER RESPONSIBILITIES

- 2018-today **Referee**  
Journal of Astronomical Instrumentation ·
- 2018-today **Referee**  
Astronomy and Computing ·
- 2011-today **Referee**  
Physical Review D ·
- 2010-today **Referee**  
Classical and Quantum Gravity ·
- 2009-today **Referee**  
Astronomy & Astrophysics ·
- 2009-today **Referee**  
Nuovo Cimento ·
- 2011-today **Referee**  
European Physical Journal Plus ·
- 2009-today **Referee**  
Review Scientific Instruments ·
- 2016-today **Referee**  
General Relativity and Gravitation ·
- 2017-today **Referee**  
Physics Letters A ·
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## PRIZES

- 2017 **Albert Einstein Medal**  
As a member of the LIGO/Virgo collaboration ·
- 2016 **Gruber Cosmology Prize**  
As a member of the LIGO/Virgo collaboration · <http://gruber.yale.edu/prize/2016-gruber-cosmology-prize>
- 2016 **Breakthrough prize**  
As a member of the LIGO/Virgo collaboration · <https://breakthroughprize.org/News/322016>
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## ABILITATIONS

- 2014 **“Abilitazione scientifica nazionale” settore 02/A1**  
Habilitation to the role of associate professor · Experimental physics of fundamental interactions.

- 2014 **“Abilitazione scientifica nazionale” settore 02/C1**  
Habilitation to the role of associate professor · Astronomy, astrophysics, Earth and planets physics.
- 2005 **I.N.F.N. Habilitation**  
Habilitation to the role of INFN researcher · Theoretical Physics.
- 2005 **I.N.F.N. Habilitation**  
Habilitation to the role of INFN researcher · Astroparticle Physics.

## COLLABORATIONS

- 2016-2019 **Coordinator contact and team member**  
European project NEWS H2020-MSCA-RISE-2016, NEw WindowS on the universe and technological advancements from trilateral EU-US-Japan collaboration · Project Id: 734303
- 6/4/2015-8/5/2015 **Research program participant**  
The Next Detectors for Gravitational Wave Astronomy · Kavli Institute for Theoretical Physics China, Pechino
- 2014-2016 **FIRB project participant**  
New perspectives on the violent Universe: unveiling the physics of compact objects with joint observations of gravitational waves and electromagnetic radiation. ·
- 2012-2015 **Member**  
GINGER (Gyroscope IN GEneral Relativity) experiment ·
- 2012-2015 **PRIN project participant**  
“Sviluppo di interferometri ottici ultra low-loss in regime ponderomotivo per la riduzione del rumore quantistico in rivelatori di onde gravitazionali e rivelazione ultrasensibile di piccole forze in sistemi micromeccanici” (Developement of ultra-low-loss interferometers in ponderomotive regime for the reduction of quantum noise in gravitational wave detecors · High sensitivity detection of small forces in micromechanical devices.
- 2010-2011 **European Council project n. 211743 participant**  
Einstein Telescope. 1. Study of Gravity Gradient noise and of techniques for its mitigation. 2. Simulation activities for seismic attenuation systems. ·
- 2002-2005 **PRIN project participant**  
“Sospensioni per specchi di rivelatori interferometrici di onde gravitazionali a basso rumore termico” (Mirror suspensions for intererometric detectors of gravitational waves with low thermal noise). ·
- 2002-today **Associate**  
European Gravitational Observatory ·
- 1996-today **Member**  
Virgo collaboration ·

- 2000 **Cofinanced university project participant**  
 “Rumore Newtoniano nei Rivelatori per Onde Gravitazionali” (Newtonian noise in gravitational waves’ detectors) ·
- 1997-2000 **MURST project participant**  
 “Angiografia Digitale ad alto Rapporto Prestazioni/Costo” (Digital Angiography with high cost/performance ratio). In the framework of the National Program of Research about Technologies in Cardiology) · Coordinator: S.I.A.S., Modena, in collaboration with the “Istituto di Fisiologia Clinica del C.N.R”. Description: Implementation of algorithms for angiography image analysis on a APE/Quadrics parallel computing architecture.
- 1995 **European project participant**  
 Georadar Embedded on Site Parallel Processing Feasibility Study-GEOSIPP/FEST (European Community program Esprit, Parallel Computing Initiative CAPRI, project n.9452/94/197/70). · Coordinator: “Ingegneria dei Sistemi” (IDS), Pisa. Description: Feasibility study for the use of a parallel computing embedded architecture in real time elaboration of IDS georadar data.
- 1995-1996 **European project participant**  
 Numerical Modelling for Electromagnetic Design and Hardening of Telecommunication Centres-ARTEMIS (European Community program Esprit, Parallel Computing Initiative CAPRI, project n.9452/94/190/70) · Coordinator: “Centro Studi e Laboratori Telecomunicazioni” (CSELT), Torino. Description: Parallelization of numerical codes for electromagnetic compatibility on APE100 and Cray T3D computing architectures.

## CONFERENCES AND SEMINARS

### CONFERENCES ORGANIZATION

- 2022 **LOC member**  
 QFC2022- Quantum gases, fundamental interactions, and cosmology · <https://agenda.infn.it/event/28726/>
- 2021 **LOC and SC member**  
 Gravi-Gamma workshop, Volterra, Italia. · <https://agenda.infn.it/event/20758/>
- 2021 **LOC member**  
 GWEOS 2019, Pisa, Italia ·
- 2021 **LOC member**  
 QFC2019- Quantum gases, fundamental interactions, and cosmology ·
- 2021 **LOC member**  
 SciNEGHE 2016, Pisa, Italia. (Workshop on Science with the New Generation of High Energy Gamma-ray Experiments) ·
- 2019 **LOC member**  
 GWDAAW 2019, La Biodola, Isola d’Elba, Italia. Gravitational-Wave Advanced Detector Workshop “From Advanced Interferometers to Third Generation Observatories ·

- 2014 **Co-chair**  
XXI SIGRAV Conference, Alessandria, Italia · Workshop experimental gravitation.
- 2003 **LOC member**  
5th Edoardo Amaldi Conference, Pisa, Italy ·

## INVITED TALKS AND SEMINARS

- February 9, 2022 **ICTP Colloquium**  
EGO and VIRGO: The Past, Present, and Future of the Physics of Gravity Waves. ·
- September 20-23, 2021 **The 7th Conference of the Polish Society on Relativity**  
Recent observations of GWs by LIGO and Virgo detectors. ·
- July 5-10, 2021 **MG16 - Sixteen Marcel Grossmann meeting**  
The recent observations of Gravitational Waves from the two Neutron Stars-Black Holes coalescences ·
- March 9-11, 2021 **La Thuile 2021 - Les Rencontres de Physique de la Vallée d'Aoste, Virtual workshop**  
Five years of gravitational wave observations: where we stand? ·
- July 1-7, 2018 **Fifteenth Marcel Grossmann Meeting - MG15**  
Data Analysis Techniques To Search For The Stochastic Gravitational-Wave Background · Università di Roma "La Sapienza"
- March 10-17, 2018 **53rd Rencontres de Moriond - EW**  
Results of LIGO-Virgo · La Thuile
- September 20, 2016 **Workshop "String Theory and Inflation"**  
Stochastic Background of Gravitational Waves · Dipartimento di Fisica University of Roma Tor Vergata
- September 12-16, 2016 **Eighth International Workshop DICE2016. Spacetime - Matter - Quantum Mechanics**  
The discovery of gravitational waves: a gentle fight against noise · Castello Pasquini/Castiglione (LI), Italia
- May 17-20, 2016 **New Frontiers in Theoretical Physics - XXXV Convegno Nazionale di Fisica Teorica and GGI 10th anniversary**  
Advanced detectors of gravitational waves: status and perspectives · Galileo Galilei Institute, Firenze
- June 7-12, 2015 **"General Relativity & Gravitation: A Centennial Perspective"**  
Panelist Perspectives Session: Future Technologies in Gravitational Wave Science · State College, USA.
- June 7-12, 2015 **"General Relativity & Gravitation: A Centennial Perspective"**  
Status of Advanced Virgo. · State College, USA.
- May 17-22, 2015 **GWADW 2015**  
Seismic Newtonian Noise · Girdwood, Alaska, USA.
- 2015 **3rd Beijing Gravitational Waves Workshop**  
A Bayesian approach to the problem of the locking acquisition of a suspended optical cavity. · Tsinghua University, Pechino, Cina.
- May 29-30, 2014 **IEEE International Workshop on Metrology for Aerospace**  
Optical Quantum Noise in High Sensitivity Measurements · Benevento, Italia.
- October 14-16, 2009 **2nd Einstein Telescope Annual Workshop**  
Gravity Gradient Noise: Estimates and Reduction Strategies · Erice, Italia.

- 2009 **Seminar APC**  
Gravitational Waves Stochastic Background: Sources & Detectors. · Paris
- May 27-28, 2009 **58th Fujihara Seminar**  
Low frequency limits (Gravity Gradient Noise) · Shonan Village Center, Hayama, Japan.
- May 23, 2008 **Virtual Institute of Astroparticle Physics**  
Gravitational Waves Stochastic Background in Interferometric Detectors · Virtual seminar.
- April 27, 2004 **Background stocastico di onde gravitazionali: sorgenti e detector**  
Dipartimento di Fisica dell'Università di Napoli ·

## SELECTED PRESENTATIONS AND SEMINARS

- July 5-12 2017 **EPS Conference on High Energy Physics, Venezia, Italia**  
Stochastic GW searches and Cosmology with GWs. ·
- October 18-21 2016 **The search for a stochastic background of gravitational waves**  
SciNeGHE 2016, High-energy gamma-ray experiments at the dawn of gravitational wave astronomy, Pisa, Italia ·
- September 12-16 2016 **The search for a stochastic background of gravitational waves.**  
TeV Particle Astrophysics 2016, CERN ·
- May 17-22 2015 **System ID for modern control.**  
GWADW 2015, Girdwood, Alaska, USA ·
- May 17-22 2015 **Output “Anti-squeezing”**  
GWADW 2015, Girdwood, Alaska, USA ·
- September 22-26 2014 **New Perspectives on the Violent Universe: toward an italian network for joint astronomical observations of gravitational waves and electromagnetic radiation.**  
100° SIF congress, Pisa ·
- March 4-5 2014 **Gravitational Wave Stochastic Background.**  
What Next in Gravitational Wave Research? EGO Cascina, Italia ·
- November 23 2010 **Some considerations about Gravity Gradient Noise.**  
3rd annual ET meeting, Budapest, Hungary ·
- 2010 **Migliorare la sensibilità a basse frequenze in rivelatori interferometrici di onde gravitazionali (Improving low frequency sensitivity in interferometric detectors of gravitational waves)**  
SIF congress 2010, Bologna, Italia ·
- October 29 2009 **La Gravitazione (Gravitation)**  
1609-2009: l'Universo di Galileo, l'Universo oggi, Pisa. ·
- July 12-18 2009 **Gravity Gradient Noise**  
12th Marcel Grossman Meeting, Parigi, Francia ·
- May 12-17 2008 **Gravity Gradient Noise: Subtraction and the Underground Option.**  
GWADW 2008, La Biodola (Elba) ·
- May 12-17 2008 **Detection Noise and Quantum Fluctuation Amplification.**  
GWADW 2008, La Biodola (Elba) ·



- March 26-28 2008 **Esperimenti per la rivelazione delle onde gravitazionali (Experiments for gravitational wave detection)**  
Incontri di Fisica delle Alte Energie, Bologna ·
- October 10 2007 **Stochastic Background Search (from a data analysis perspective).**  
2nd ENTApP-GWA joint meeting on gravitational waves sources and observation, Tuebingen ·
- October 8-9 2007 **Stochastic Background Search with VIRGO and GEO.**  
4th ILIAS-GW annual general meeting, Tuebingen ·
- September 24 2007 **Una applicazione dello squeezing al miglioramento della sensibilità dei rivelatori interferometrici di onde gravitazionali (An application of squeezing to the improvement of the sensitivity in interferometric detectors of gravitational waves).**  
XCIII Congresso Nazionale SIF, Pisa · Special mention for best talk.
- May 11-13 2007 **Studio delle onde gravitazionali**  
Incontri di Fisica delle Alte Energie, Napoli ·
- 2006 **Underground reduction of gravity gradient noise.**  
GWADW, La Biodola (Elba) ·
- April 27 2006 **Interferometers without optical coatings.**  
ILIAS meeting, Firenze ·
- 28 March 2006 **Newtonian noise under the ground.**  
3rd ILIAS annual meeting, Laboratorio nazionale Gran Sasso ·
- 23-24 January 2006 **Stochastic Background: data analysis.**  
First ENTApP - GWA joint meeting, Paris ·
- March 18, 2005 **Il principio di indeterminazione di Heisenberg e la rivelazione delle onde gravitazionali (Heisenberg indetermination principle and gravitational waves detection)**  
Workshop "Le onde gravitazionali, una nuova finestra sull'Universo", Domus Galilaeana Pisa. ·
- December 15 2004 **Simulation of gravitational wave stochastic background**  
GWDAW-9 workshop, Annecy ·
- December 15 2004 **A couple of techniques to improve sensibility preserving robustness in gravitational waves burst detection**  
GWDAW-9 workshop, Annecy ·
- November 26 2004 **Virgo: il detector e le sorgenti (Virgo: sources and detector)**  
Meeting "Astrofisica in Toscana 2", Pisa ·
- October 21 2004 **Beyond the standard quantum limit.**  
2004 IEEE Nuclear Science Symposium, Roma ·
- September 16 2004 **Beyond the standard quantum limit.**  
16th SIGRAV conference on General Relativity and Gravitational Physics, Vietri sul Mare (SA) ·
- December 20 2003 **Optimal vetoes and best matching for coalescing binaries events.**  
GWDAW-8 workshop, Milwaukee ·
- February 7 2003 **Dealing with Newtonian noise above and below the ground: a review.**  
Aspen 2003 GWADW winter conference ·
- May 22 2002 **A case study in binary coalescing detection: optimal matching with amplitude corrections.**  
Elba 2002 GWADW ·

- December 15, 2001 **GWIC working group report.**  
GWDAAW 2001, Trento ·
- 2001 **Status of Virgo.**  
Aspen Winter conference ·
- February 16, 2000 **End to end simulation**  
Stanford University seminar ·
- October 13 2000 **Tools for freezing optics**  
GREX Workshop 2000 ·
- November 23, 1999 **MSE. A mechanical simulation engine for the LIGO E2E model**  
California Institute of Technology Seminar ·
- 23-30 January 1999 **Off line subtraction of Seismic Newtonian noise.**  
XXXIVth Rencontres de Moriond, Gravitational Waves and Experimental Gravity, Les  
Arcs, Savoie, France ·
- 1998 **Off-line Subtraction of Seismic Newtonian Noise.**  
13th Italian Conference on General Relativity and Gravitational Physics, Monopoli ·
- May 20-24 1996 **Triggering and Data Analysis for the VIRGO experiment on the APEmille parallel  
computer.**  
6th topical seminar Experimental apparatus for particle physics and astrophysics, S.  
Miniato (PI) ·

## TEACHING EXPERIENCE

### UNIVERSITY

- 2016-today **Astroparticle**  
Physics department · Pisa University
- 2013-2020 **Physics 1**  
Physics department · Pisa University
- 2015-2016 **Gravitational waves**  
Physics department · Pisa University
- 2009 **General relativity**  
Mathematics department · Pisa University
- 2003-2012 **Physics 1**  
Physics department · Pisa University
- 2004-2007 **Physics 2**  
Physics department · Pisa University
- 2004 **Complements of physics**  
Mathematics department · Pisa University
- 2001 **Thermodynamics**  
Mathematics department · Pisa University

## TEACHING IN GRADUATE SCHOOLS

- 4-8 July 2022 **1st MaNiTou Summer School on Gravitational Waves**  
Latest News from LIGO/Virgo ·
- 15-24 June 2022 **International School of Subnuclear Physics Erice: 58th Course: Gravity and Matter in the Subnuclear world.**  
Observing the universe through gravitational waves: what we are learning? ·
- 16-20 July 2018 **International Alpine School of Mathematics and Physics, Domodossola**  
The physics of LIGO and Virgo ·
- May 7-11 2018 **XIX Frascati Spring School Bruno Touschek in Nuclear, Subnuclear and Astroparticle Physics.**  
Gravitational Waves: Detectors and Data Analysis. · Laboratori Nazionali di Frascati.  
<https://agenda.infn.it/event/14992/>
- 2015 **2015 International School on Numerical Relativity and Gravitational Waves**  
Gravity Gradient Noise ·
- 2011 **Spring VESF data analysis school 2011**  
Stochastic background data analysis ·
- 2010 **5th VESF school on gravitational waves**  
Continuous Sources and Stochastic Background · Sesto di Pusteria 2010
- 2002-2008 **VIRGO-SIGRAV school on gravitational waves**  
Techniques of quantum non demolition ·
- 1994 **International School of Advanced Studies (ISAS) di Trieste**  
Scientific application of parallel calculations. ·
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## THESIS SUPERVISION

### PH. D. THESIS SUPERVISION

### MASTER THESIS SUPERVISION

December 14, 2023

February 27, 2023

December 14, 2022

October 27, 2022

July 22, 2022

December 13, 2021

2019

2019

2018

2018

2017

2017

2017

2016

2016

2016

2015

## BACHELOR THESIS SUPERVISION

2014

2013

2012

2012

2011

2011

2010

2010

2010

2009

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## OUTREACH

### HIGH SCHOOL SEMINARS

- 2021 **La realtà e i modelli della fisica: termodinamica, meccanica statistica e strutture emergenti (Reality and physical models: thermodynamics, statistical mechanics and emergent structures)**  
Liceo Scientifico "A. Volta" · Reggio Calabria
- 2020 **La descrizione geometrica dell'Universo. Einstein e oltre. (The geometrical description of the Universe: Einstein and beyond)**  
Scuola estiva Filosofia Roccella Scholé · Roccella Jonica
- 2019 **La scoperta delle onde gravitazionali. (The discovery of gravitational waves)**  
ITIS Marconi · Pontedera
- 2019 **Lo spaziotempo curvo. (Curved spacetime)**  
Liceo Scientifico "P. Mazzone" · Roccella Jonica
- 2013-2016 **Einstein a flatlandia: dalla geometria alla cosmologia (Einstein in flatland: from geometry to cosmology)**  
Pianeta Galileo ·
- 2012 **Fisica moderna e descrizione del mondo: Microcosmo (Modern physics and description of the World: microcosm)**  
Several High Schools ·

- 2012 **Fisica moderna e descrizione del mondo: Macrocosmo (Modern physics and description of the World: macrocosm)**  
Several High Schools ·

## PUBLIC SEMINARS

- 2024 **Buchi neri: un viaggio tra la conoscenza e l'ignoto**  
Fisica al Pub · Pisa January 15, 2024
- 2023 **Buchi neri: un viaggio tra la conoscenza e l'ignoto**  
Lucca Comics · Lucca November 4, 2023 <https://www.ego-gw.it/blog/2023/10/24/ego-e-virgo-a-lucca-al-comicsscience-palace/>
- 2020 **Capire una epidemia con la matematica (Understand mathematically a pandemic)**  
Filosofia Roccella Scholé, Roccella Jonica ·
- 2019 **Meccanica quantistica e senso comune (Quantum mechanics and common sense)**  
Seminario pubblico, Filosofia Roccella Scholé, Roccella Jonica ·
- 2018 **Einstein a Flatlandia (Einstein in flatland)**  
Incontro pubblico, Cittadella Galileiana, Pisa ·
- 2018 **Colloqui sull'Universo: Dall'infinitamente piccolo all'infinitamente grande. (Speaking about the Uni- verse: from the infinitely small to the infinitely large)**  
Incontro pubblico, Domoschool - International Alpine School of Mathematics and Physics, Domodossola ·
- 2018 **Sulla cresta dell'onda gravitazionale (Diving gravitational waves)**  
Seminario pubblico, Pint of Science Siena, Siena ·
- 2018 **La rivelazione delle onde gravitazionali: una nuova prospettiva sull'Universo (Gravitational wave detection: a new perspective on the Universe)**  
Seminario pubblico, Filosofia Roccella Scholé, Roccella Jonica ·
- 2017 **Un cambio di paradigma in due mosse: Dalla meccanica di Newton alla relatività speciale (A two step change of paradigm: from Newton mechanics to special relativity)**  
Fondazione Dino Guerra - La dove il pensiero incontra l'esperienza: invito alla lettura dei classici della scienza ·
- 2016 **Un cambio di paradigma in due mosse: Dalla relatività speciale alla relatività generale (A two step change of paradigm: from special relativity to general relativity)**  
Fondazione Dino Guerra - La dove il pensiero incontra l'esperienza: invito alla lettura dei classici della scienza ·

## OTHER

- 2004–today **Introductory seminars for visitors at European Gravitational Observatory**  
European Gravitational Observatory · Cascina, Italy

## PROFESSIONAL ABILITIES

- Excellent knowledge of programming languages and techniques (C, C ++, python, fortran) in traditional and parallel environments (pvm, mpi, multithreading).
  - Excellent knowledge of techniques and languages of symbolic manipulation (Mathematica, Maple)
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## COURSES

- 2011 **Le azioni PEOPLE del VII Programma Quadro dell'Unione Europea**  
INFN training · Roma
  - 2011 **Quantum mechanics meets gravity**  
INFN training · Roma
  - 2008 **GRID users' school**  
INFN training · CNAF Bologna
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## CONSULTINGS

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|--|---|
| <b>Tecnobiomedica S.p.A, Pomezia</b>       | Implementation of a ventricular position sensor |
| <b>European Community</b>                  | Neural Network applications                     |
| <b>Ingegneria Dei Sistemi S.p.A., Pisa</b> | Parallel computing applications                 |
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## LANGUAGES

- English:** Good knowledge
  - French:** Scholastic knowledge
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## AFFILIATIONS

2004-today **SIF, Società Italiana di Fisica**

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2016-today **EPS, European Physics Society**

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1996-today **SIGRAV, Società Italiana di Relatività Generale e Fisica della Gravitazione**

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