OLIVIERO CREMONESI

Date and place of birth:
ORCID:

EDUCATION

1987	PhD in Physics, University of Milan, Italy
1982	Degree in Physics at University of Pavia, Italy

CURRENT POSITION

2006 - present	Research Director (lev. I), INFN Milano Bicocca, Italy

PAST POSITIONS

1995 - 2005	Senior Researcher (lev. II), INFN Milan, Italy
1990 - 1995	Researcher, Physics Department, University of Milan, Italy
1989	Fixed term researcher , INFN Milan, Italy
1987	Post-doc position, INFN Milan, Italy

NATIONAL AND INTERNATIONAL RESPONSIBILITIES

2020 - present	Chair of the INFN National Scientific committee for Astroparticle
2012 - 2020	Spokesperson of the CUORE international collaboration
2010 - 2020	National PI of the CUORE experiment, INFN
2003 - 2012	Technical coordinator of the CUORE international experiment
2003 - 2009	PI (with INFN funds) for the CUORE Milano and Milano-Bicocca group

NATIONAL AND INTERNATIONAL COLLABORATIONS

2005 - 2020	Member of the CUORE and CUORE-0 Collaborations (Europe-USA- China)
2003 - 2008	Member of the Cuoricino Collaboration (Europe-USA)
1989 - 2003	Physics and Data Analysis coordinator of the Milano group pioneering the use of low temperature detectors for rare event searches
1986 - 1998	Member of the GALLEX Collaboration (Europe-USA-Israel)
1985 - 1990	Member of the Gran Sasso experiment on double beta decay of ^{136}Xe
1983 - 1986	Member of the Mont Blanc experiment on double beta decay of ^{76}Ge
1982 - 1983	Member of the NUSEX Collaboration (CERN-Italy)

MEMBERSHIP SCIENTIFIC BOARDS

2023 - present	Member of the DOE panel for Neutrinoless Double Beta Decay
2014 -2019	Member of the USA Department Of Energy (DOE) Review Committee of the Majorana international Project
2013-2016	Chair of the CUPID Steering Committee
2010-2012	Member of the CERN SP and PS Experiment Committee
2004-2009	Observer in the Scientific committee for nuclear physics, INFN.
2003-2009	Member of the INFN Scientific Committee for Astroparticle Physics

TEACHING ACTIVITIES

2012 - present	"Particle physics I", master's degree - Milano-Bicocca University, Italy
2013 - 2017	Monographic course on "Double beta Decay", PhD - Gran Sasso Science Institute, L'Aquila, Italy

2009 - 2011	"Particle physics II", master's degree - Milano-Bicocca University, Italy
2003 - 2009	"Digital systems electronics I", major - Milano-Bicocca University, Italy
2002 - 2010	"Signal acquisition and processing", major - Milano-Bicocca University, Italy
2000	"Electronics and computing", complementary course, graduate school in health physics - Milan University, Italy
1999 - 2000	"Experimentations of Physics II", complementary course, major - Milano-Bicocca University, Italy
1995 - 2000	Courses on Neutrino physics, Particle detectors, Data analysis, PhD - Milan University, Italy
1994 - 2001	"Superior physics", complementary course, major - Milan University, Italy

TUTORING AND MENTORING

Tutor for several undergraduate and PhD students of the Milan, Milano-Bicocca Universities and GSSI. I have been mentoring tens of young researchers during my participation in international collaborations.

REFEREE/REVIEWER

- Reviewer of scientific journals (Physics Letters B, European Physics Journal C)
- Referee of several experiments for the nuclear and astro-particle physics scientific committees of INFN
- Reviewer of new physics projects for international funding agencies (CNRS, Canadian NSF, USA NSF)

RESEARCH OUTPUT

- 340 publications, h-index 50, 19309 citations(source SCOPUS)
- Almost 40 invited presentation at scientific international conferences, international schools (most of which abroad: Europe, USA, Japan).

MAIN RESEARCH INTERESTS

- nucleon stability
- solar neutrinos
- neutrino properties
- rare nuclear decays and dark matter detection (WIMPS/axions)
- development of phonon mediated single particles detectors (bolometers) with scintillation and thermal read-out
- study of trace radio-contaminants and of techniques for their reduction
- data analysis and Monte Carlo simulations for low energies

Since the beginning of my career, my research interests has led me to study novel approaches, instruments and techniques able to face the demanding experimental requirements typical of the rare event searches.
Indeed, after entering the NUSEX collaboration in 1982 as an undergraduate student at the Milan University, most of the activities of the years following my graduation are devoted to pioneering new experimental strategies.

In 1983 I joined the small 'Milan group' at INFN and Milan University which was proposing the use of commercial germanium diodes for the search of neutrino less double beta decay of ^{76}Ge.
The intuition was fruitful: two of them were installed in the Mont Blanc tunnel and provided the most stringent limits to date on neutrino less double-beta decay and paved the way to a true dynasty of proposals which include the recent GERDA and Majorana projects.
In 1986, driven by a desire to extend my interest for the physics of neutrinos, I joined the proposers of a European Collaboration aiming to build a challenging experiment on low energy solar neutrinos: GALLEX. The experiment first demonstrated that energy in the sun is produced by a chain of nuclear fusion reactions and that the solar neutrino puzzle is driven by unexpected properties of the neutrinos. I worked to the development and optimisation of the new sensitive gas counters and gave a substantial contribution to the signal analysis proposing a new approach (optimum filter) that provided an independent validation of the standard analysis method.
In 1986 the Milan group completed the installation of a multi proportional gas chamber at the INFN Gran Sasso National Laboratories (LNGS), to search for neutrino less double beta decay of ^{136}Xe. Together with the Gotthard TPC, this is the first use of Xenon.
The quest for the best technology for rare event searches convinced me to join the Milan group effort, lead by Prof. E.Fiorini, for the development of low temperature detectors in 1989. I soon took the lead of the data analysis and physics program developing all the needed software.
In the 90's we created two different research lines based on bolometers: microbolometers (milligrams to grams) for the study of the end part of the ^{187}Re beta spectrum (direct measurement of the antineutrino mass) and macro-bolometers (kg) for neutrino less double beta decay. In particular we developed the world first large mass bolometers, with energy resolutions comparable (or even better) to those of conventional devices. We realized a number of experiments funded by INFN under the MIBETA abbreviation and paved the way for the ambitious projects like Cuoricino and CUORE. My role as coordinator of the data analysis and my reputation as responsible of the physics program were constantly increasing in these very important years.
At the beginning of the 2000's, based on the longstanding experience with the development of low temperature detectors I started undertaking relevant responsibilities. In 2003 I became responsible for the INFN Milano division funds of Cuoricino and CUORE and turned definitely to macrobolometers, abandoning the development of microbolometers. Based on my experience from the construction and operation of Cuoricino, in the same year I was designated as technical coordinator of the CUORE project. I maintained this leadership for about ten years, covering the design, preparation and construction phases of the experiment. These have been very intense years characterised by frequent visits to all the collaborating groups around the world (Italy, USA and China) and accurate controls on the construction activities at the selected companies. CUORE is the largest bolometric experiment ever built and is today among the most competitive experiments in this field. It represents a true technological challenge characterised by a cryogenic system of unprecedented dimensions.
In 2010 I became national PI of the CUORE activities and funds, increasing my leading role in the experiment and maintaining continuous contacts with INFN management. In 2012 I was eventually elected spokesperson of the whole CUORE Collaboration, which includes about 20 Institutions in Europe, U.S. and China and is funded by INFN, DOE and NSF. CUORE numbers about 150 scientists from Europe and USA. Its total cost has been estimated to be around 30 million Euros of which about two thirds provided by INFN

under my responsibility. Leading the Collaboration to operation in 2017 has been my greatest success. I finally resigned from this role in February 2020 when I was elected chairman of the national scientific committee of INFN (CSN2). Role confirmed for a second 3-year term in February 2023 and which I therefore also hold at present.

The research results beyond the state of the art to which I contributed in my career are highlighted in the list of publications. . In the following, the ten most representative invited presentations to international Conferences:

- **Search for neutrinoless double beta decay with bolometric devices.** 14th Weak Interactions and Neutrinos, July 19-24 1993 - Seul, Korea
- **Low temperature detectors for neutrino physics: results and developments,** 16th Weak Interactions and Neutrinos, June 1997 - Capri, Italy
- **Present and future of low temperature detectors,** 18th International Conference on Neutrino Physics and Astrophysics, June 1998 - Takayama, Japan
- **Double beta decay experiments with thermal detectors,** MEDEX '99, July 1999 - Prague, Czech Republic
- **Cryogenic Detectors for Double Beta Decay**, IX Low Temperature Detectors, July 2001 - Madison (WI) USA
- **Neutrinoless double beta decay: present and future,** 20th International Conference on Neutrino Physics and Astrophysics, June 2002 - Munich, Germany
- **New Cuoricino results and the CUORE project,** 5th Workshop on Neutrino Oscillations and their Origin, February 2004 - Tokyo, Japan
- **Double beta decay: Experiment and theory,** 22nd International Symposium on Lepton-Photon Interactions at High Energy, June 2005 - Uppsala, Sweden
- **Probing Neutrino low energy and mass scales,** Neutrino Oscillation Physics (NOW 2006), September 2006 - Otranto, Italy
- **Neutrino masses and Neutrinoless Double Beta Decay: Status and expectations,** European Strategy for Future Neutrino Physics, October 2009 - CERN, Geneva, Switzerland
- **Double beta decay searches**, 4th Nuclear Physics in Astrophysics, June 2009 - Gran Sasso, Italy
- **Neutrinoless double beta decay searches,** DISCRETE 2010, December 2010 - Rome, Italy
- **Developments on double beta decay search,** 11th Heavy Quarks and Leptons, June 2012 - Prague, Czech Republic
- **Neutrino masses,** The European Physical Society Conference on High Energy Physics, July 2013 - Stockholm, Sweden.
- **Experimental searches of neutrinoless double beta decay,** NOW2012 conference, September 2012 - Conca Specchiulla, Italy
- **Neutrinoless Double Beta Decay,** TAUP 2015, September 2015 - Turin, Italy
- **First results from the CUORE experiment**, TAUP2017, July 2017 - Sudbury, Canada
- **Experimental search of neutrino-less double beta decay in 130Te**, CNNP17, October 2017 - Catania, Italy

Curriculum Vitae
Pia Astone
Dirigente di Ricerca, INFN, Sezione di Roma
LIGO/Virgo/KAGRA and ET collaborations, for the search of gravitational waves

CURRICULUM VITAE

Personal Information:

Astone
Pia
ORCID: 0000-0003-4981-4120

Education:

1984: Master degree in Physics, " Laurea Vecchio ordinamento" , Score: 110/110 cum laude
Physics Department of the Rome University La Sapienza

Current Position(s):

From 01/01/2021: Dirigente di Ricerca (First level) INFN, Rome division
Academic year 2022-2024: Contract Professor, Engineering DIAG Department, Sapienza University of Rome

Previous Positions:

Fall 1984-May 1986: teaching experiences in secondary italian schools, at the military school for aereonautics in Pratica di Mare. Volunteer assistant at the Engineering Dept. of La Sapienza University.

June 1986-30/11/1988: Radar project designer, Contraves (Rome).

01/12/1988-30/11/1990: INFN non-permanent researcher position
01/12/1990-28/02/2000: INFN researcher position (third level)
01/03/2000-31/12/2020 INFN first researcher position (second level)

Academic year 2021-2022: Contract Professor, Facoltà di Scienze Matematiche Fisiche Naturali of La Sapienza University

Fellowships and awards:

GW=Gravitational Waves.
15/05/2016: Special Breakthrough Prize for the direct GW detection;
12/07/2016: Gruber Cosmology Prize for the first GW detection, http://gruber.yale.edu/ligo-team-members.
07/06/2017: Einstein Medal.
11/12/2017: Physics World 2017 Breakthrough of the Year Award for the direct GW detection

ASN habilitation for Full Professor, first level, scientific disciplinary sector FIS02 / C1 (Astronomy and Astrophysics), validity: 16/05/2019-16 / 05/2030
ASN habilitation for Full Professor, first level, scientific disciplinary sector FIS02 / A1 (Physics of Fundamental Interactions), validity: 20/12/2019-20 / 12/2030

SUPERVISION OF GRADUATE STUDENTS; PhD POSTDOC STUDENTS:

2022-2025: Supervisor/Co-Supervisor of four PhD in Physics, Sapienza Univ. of Rome (joint with Ariel, Israel, Sandhya S. Menon), Cagliari University (Loenzo Mirasola), Napoli Federico II (Martina Di Cesare), National Institute for Space Research, Brazil (Julio C. Martins)

2016-2019: Supervisor of one PhD in Physics, Sapienza Univ. of Rome (joint with Florida University, US, Andrew Miller)
2023-2025: 1 Post-doc, INFN Rome (PNRR ICSCS)
2023-2025: 1 Post-doc, INFN Rome (PRIN2020BRP57Z)
2023-2025: 2 Post-docs, Sapienza Rome (PRIN2020BRP57Z.)
2021-2023: 1 Post-Doc, INFN Rome (Fellini)
2022-2023: 1 Post-Doc, Sapienza, Rome (Amaldi Research Center)
2020-2021: 1 Post-Doc, Sapienza, Rome (Amaldi Research Center

TEACHING ACTIVITIES:

2011-2022: Tutor of 9 students, Summer students program IREU, Florida,

2020-2021, 2021-2022. PhD in Physics, Sapienza, Rome. Advanced data analysis techniques.

2022-2023 and 2023-2024. Engineering DIAG Department, Sapienza. Rome. Physics

2021-2022: Facoltà di Scienze Matematiche Fisiche Naturali SMFN, Sapienza Rome, Physics 2

2005 - 2022: Faculty of Pharmacy, Sapienza. Rome. Physics

Nel 2022 ho contribuito all' adattamento dei testi del volume SBN: 9788836230730 , per una edizione italiana con contenuti rielaborati per il livello di corsi di Fisica delle nostre Università, in particolare al di fuori della facoltà di scienze. Titolo: Fondamenti di Fisica . Autori: Serway - Jewett . Editore: Edises (adattamento a cura di R. Bellotti, V. Cataudella,...P. Astone, et al.)

ORGANISATION OF SCIENTIFIC MEETINGS:

LOC:Local Organizing Comm.; SOC: Scientific International Comm.

2024: LOC and SOC of the second GEMMA conference on GW, Multimessenger Astronomy, Dark Matter, Rome, Physics Dept. Sapienza, Italy.

2023: LOC "The rise of Particle Physics",IOP, Rome Italy (2024)
2022: LOC Pharos conference Rome, Italy
2019: LOC of the "First European Physicist Society Conference on Gravitation", Rome.
2018: SOC, GEMMA conference on GW, Multimessenger Astronomy, Dark Matter, Lecce, Italy.
2016: SOC and LOC, 5th GraWIToN School, Rome, Italy
2010: LOC of the GWDAW-14, Rome

INSTITUTIONAL RESPONSIBILITIES:

June 2022-June 2025: National PI of the PRIN 2020BRP57Z. International activity,
Sept 2022-Sept 2025: Local coord. of the ICSCS Spoke 2 PNRR.
From 2020 and until December 31, 2024: Chair of the Virgo Rome group and member of the Virgo Steering Committee (VSC) 2018-2022: Member of Steering commitee of the Amaldi Research Center, Sapienza. Rome
2019-2023: National coordinator of the INFN Lab2go projects, for Physics lab activities in secondary schools, Italy
2012-2014: Scientific co-coordinator of the LIGO/Virgo collaboration,member of the VSC. Activity to prepare the science that resulted in the GW discovery.
2012-2014: Computing coordinator, Advanced Virgo Project. International.
2013: LIGO /Virgo task force for the renewal of the agreement
2010-2012: Co-chair of the Continuous Wave (CW) LIGO/Virgo group. International.
2012-2015: chair of the ROG Rome group. Rome, Italy.
1998-2003: co-chair of the "International Gravitational Event Collaboration"

REVIEWING ACTIVITIES:

2024: Reviewer of ERC Advanced grant proposals

2023:Reviewer of the "Scientific Research Funding Call: Small and Medium-Size Research Projects" of Sapienza, Rome.
2023: Reviewer of the "Science, Tecnology Facilities Country (STFC) Technology and Skills Call 2023", for the The Indian Department for Atomic Energy (DAE) and the STFC council
2022: Reviever for Poland grant proposals, National Science Center, NCN Panel Stp. Polonia
2022: Commssion to assign a 3 years researcher position (RTDA) in Astronomy and Astrophysics in SISSA, Trieste
2022: Commisison to assign a technological 3-year position, for the ERC DARK project, Sapienza, Rome
2020: Reviewer of STFC proposals, STFC2020 GW, UK
2020: Reviever for Poland grant proposals, National Science Center, NCN Panel Stp. (Preludium-19, ST9: Astronomy and Space Science) Polonia
2018- member of the INFN commission for the recruitment of 3 permanent researchers, III level (research theme: experimental GW searches), call 20010/18.

2012-2013: review of some ANVUR proposals
Since ~ 1998: Reviewer of many journals (PRD, CQG, PRL..)

MEMBERSHIPS OF SCIENTIFIC SOCIETIES:

--From Aug. 2024: Elected member of the IAU Commission D1 (Gravitational Wave Astrophysics), https://www.iau.org/science/scientific_bodies/commissions/D1/

-International Astronomical Union (IAU) permanent member

-Italian Society of General Relativity and Gravitation (SIGRAV) permanent

-Italian Society of Physics (SIF) Renowed yearly.

MAJOR COLLABORATIONS:

From 2022: member of the Einstein Telescope (ET) collaboration. International. GW searches
From 2007: member of the LIGO/Virgo collaboration, now the LIGO/Virgo/KAGRA collaboration. GW searches, with present responsibilities within the CW group.
From 2003: member of the Virgo collaboration. GW searches. 2012-2014: Activity to prepare the science that resulted in the GW discovery.

TRACK RECORDS

Track Record:

Author of over 380 papers in international refereed journals. Index H (Scopus,2023): 90
RESEARCH FIELDS
• Physics of GWs; GW Data Analysis, with expertise in stochastic background research and transient signals (at the beginning) and in the research of continuous and long transient gravitational waves (CW), in more recent years; Observational relativity and cosmology. Noise hunting. Computational issues. My main interest and goal is the detection of signals from neutron stars (NS), both of known parameters (such as the pulsar of the Vela and Crab) and unknown ("All-Sky searches" aimed at the whole sky, the whole frequency band [10-2048] Hz and a wide spin-down range).
• Outreach activities, for dissemination of results related to GW searches and activities for physics laboratories in secondary Italian schools.

INVITED TALKS to Conferences, PhD schools:
In addition to numerous specific contributions to scientific conferences and seminars (as well as collaboration meetings) I have been invited as a speaker in the plenary sessions of numerous international scientific conferences. Among others, already in 2001 I was invited to Perth for the "4th E. Amaldi Conference" to summarize the results and status of the resonant GW detectors. Coming to the last years, in 2015 I was invited to the Marcel Grossman meeting, to talk about the state of CW signal searches, in LIGO / Virgo. I have been invited twice, by the organizers of the Spanish General Relativity Meeting (ERE). The last time was in September 2015 (immediately before GW's discovery). In December 2017 I was invited to present the recent discoveries of LIGO / Virgo at the workshop of the Italian Space Agency (ASI). From January to March 2018, I was invited to 3 other international conferences, on different topics, all related to my research activity on GW. In May 2018 I was invited to the workshop "Light, Imaging, Microscopy, Spectra" (LIMS), http://www.frascati.enea.it/LIMS2018/, on the role of optical technologies in the discovery of GW.

LIST of 11 recent INVITED TALKS to international conferences/schools:

MAY 2024: GWPAW 2024, Invited talk: The Search of Gravitational Waves with Ground based detectors: recent results and discovery frontiers. Birmingham University.
OCT 2023: GRASP2023, "Recent results and future challenges for isolated continuous gravitational wave searches with a network of terrestrial gravitational wave detectors" Pisa.IT
JUL 2022: Bulgarian Space School "The search for GW..". Theory and practical sessions. For PhD students. Invited under the suggestion of the Nobel Laureate, Prof. B. Barish. Bulgary.
JUN 2022: 12 Iberian GW meeting " Recent results and future challenges for the search of CWs with the LIGO and Virtgo detectors", Portougal.
JAN 2020: TMEX2020: : "The search of gravitational waves with ground-based detectors" Vietnam
JUN 2019 INAF, Science Archives and Big Data challenge. "``Challenges in data management and distribution within the terrestrial network of gravitational wave detectors ", Rome.IT
MAR 2018, Actual Problem in theoretical Physics "Present results and future challenges with the network of gravitational wave detectors", Vietri Sul Mare, IT
MAR 2018, GRASS: Gravitational Waves Science and Technology Symposium "Recent results and future challenges for Continuous waves and Stochastic background searches with a network of gravitational wave detectors" Padova, IT
FEB 2018, Clues on GRB origin from chemical evolution models. "Observation of gravitational waves from a binary neutron star merger with LIGO and Virgo detectors", Sexten, IT
DEC 2017, ASI (Italian space Agency) GW workshop. "Observation of gravitational waves from a binary neutron star inspiral with the LIGO and Virgo detectors", Rome.IT
SEP 2015, Spanish Relativity Meeting, ERE2015 "GW searches with the LIGO and Virgo detectors: recent results and perspectives for the upcoming Advanced Detectors Era", Palma De Majorca, Spa

My main scientific interest within the LIGO/Virgo/KAGRA (LVK) collaboration is the science of neutron stars (NS) and data analysis (DA) for the detection of continuous gravitational waves (CW) from rapidly rotating neutron stars (NS). CW signals have not yet been detected, but important efforts come both from the experimental side and from the use of more sophisticated and robust data analysis tools, and this is my field of expertise. More recently, my interest started to cover also the detection of signals due to long-transient GW emission, like those produced by the birth of a rapidly rotating magnetar following a supernova explosion. or the merger of two NSs. Some of these aspects, the work done to design solid procedures, and some recent results obtained with my specific and strong involvement, are documented in the papers I am going to list here.
Within the LVK I am also internal reviewer of analysis pipelines and/or search results.

SELECTED LIST OF 12 PAPERS (my contribution described below), ordered for topic covered
PRD=Physical Review D; APJ: The Astrophysical Journal

PRD 90: 042002 (2014) FH (Frequency Hough) method for CW searches
PRD 96, 062002 (2017) All-Sky searches, O1
PRD 100, 024004 (2019) O2 All-Sky searches
PRD 106, 102008 (2022) O3 All-Sky searches

PRD 98, 102004 (2018) GFH method for Long transient searches
APJ 875, 2, (2019) Post merger search
PRD 100, 062005 (2019) Machine learning method for long transient's searches
PRD 98, 122002 (2018) ML for transients

PRD 106, 042009 (2022) Dense CW signals and their impacts in the analysis

PRL 116, 061102) (2016) GW150914 (The first discovered GW signal)

PRD 110.082004 (2024) Method to search for inspiraling planetary-mass ultracompact binaries using the generalized frequency-Hough transform

PRD 110.103047 (2024) Neural network method to search for long transient gravitational waves

Description of main scientific results:

Regarding All-Sky searches and Long-Transient searches for CWs (Continuous GW searches):

PRD 90: 042002 (2014): It's the description of the search method (the Frequency Hough (FH) Transform) used in the All-Sky CW searches, done within the LVK collaboration, under my responsibility.
The method has been used in many collaboration papers, in particular for the results of All-Sky searches using the O1, O2 and O3 observing runs of advanced detector's data:
PRD 96, 062002 (2017), PRD 100, 024004 (2019), PRD 106, 102008 (2022). Improvements to the method have been done during these years and are described in 3 cited papers.
FH method has been successfully used also in other CW searches and for follow up of candidates.
I worked also, giving a major contribution, on the analysis for the search for a signal following the merger of the two neutron stars, which produced, in August 2017, the **GW170817 signal**. Here we have applied a procedure that is the result of a modification of those applied to search for continuous signals (Generalized Frequency Hough, GFH), based on the idea of Andrew Miller, my PhD student at that time. We have also done some comparison studies to carry on the search with Machine Learning (ML), in particular using Convolutional Neural Network (CNN).
GFH method is described here: **PRD 98, 102004 (2018).** It has been used to search for a possible long transient following the coalescence GW170817. The result has been published with an LVK papers, in **APJ 875, 2, (2019).** A preliminary study of the application of CNN tools has been published in **PRD 100, 062005 (2019).**
I have also contributed to a methodological article to identify a procedure for detecting short transients from supernova explosions, **PRD 98, 122002 (2018).**
The impact of signal clusters in wide-band searches for CW searches, very relevant for future detectors like ET and also for some cases of ultra-light dark matter (DM) searches has been, mainly by me and my student L. Pierini, in **PRD 106, 042009 (2022).**

I am presently responsible **for All-sky searches** on isolated Neutron Stars on LIGO data **of the latest scientific run O4a**, that will be published in the spring/summer of the upcoming year, 2025 (the search is very long as computationally bounded, and consists of several analysis steps) and on a search around the time of the recent SN explosion, **SN2023ixf,** happened in May 2023 during a LIGO engineering run, in which we aim at putting an upper bound on the signal emitted during the birth process of the remnant. The source is estimated to be too far to detect the GW signal, but this is a good exercise to design and run a new optimized procedure, based on a generalization of the more classical Frequency-Hough procedure.
I am also responsible for creating a particular data base of the LIGO/Virgo/KAGRA data, needed for many analysis (**the FFT data base**, named the SFDB) These data, when the proprietary data period ends, are available for usage by external groups).

I have been **the scientific co-coordinator of LIGO/Virgo in the years 2012-2014**, where we were preparing the advanced detectors era science, and thus my contribution to the first GW discovery was relevant and I was one of the 6 scientists (only 2

of Virgo) in charge **of writing the discovery paper on GW150914** (PRL 116, 061102) (2016). See the article in LIGO magazine: https://www.ligo.org/magazine/LIGO-magazine-issue-8-extended.pdf#page=34

Outreach:

I am also actively involved in outreach activities. During the last year,2024, I have participated as invited speaker to the Genova, Bergamo and Fermo festivals. In Genova I have also contributed to the laboratory on Gravitational Waves, organized with my Rome Virgo group.

I have also given seminars in schools, at different levels, and am presently in the organizing committee and tutor of the Lab2go PCTO project (which is an INFN and Sapienza project for secondary Italian schools, aimed at promoting the laboratory practice in schools).

For this, see the paper in the proceedings of the 2022 INTED conference (16th International Technology, Education and Development Conference), by Giulia De Bonis and myself: "Lab2go: a project for supporting laboratory practice in teaching stem disciplines in high school".

I am also one of the Pint of Science Rome organizers, team Roma-Frascati: https://pintofscience.it/team/Team%20Roma-Frascati.

The podcast "Virgo l'Universo si fa suono" https://www.raiplaysound.it/programmi/virgoluniversosifasuono

contains several contributions from me (RayPlay, together with the EGO, European Gravitational Observatory support).

The paper A. Bile,..P. Astone et al, "Gravitational music: a mathematical-musical model for the popularization of gravitational waves"

in Physics education (2024) is another example of my outreach and teaching activities.

My personal web pages contain some references mainly for outreach activities. There are also pages that can be useful to see the material produced during academic activites (https://www.roma1.infn.it/~astone/didattica/)

In fede,

Pia Astone

Autorizzo il trattamento dei miei dati personali ai sensi del Decreto Legislativo 30 giugno 2003, n. 196 "Codice in materia di protezione dei dati personali".

CURRICULUM VITAE

Name: Enrico Calloni
Position: Full Professor Università di Napoli Federico II
Date of birth:
Place of birth:
Gender: Male
Citizen: Italian
Work address:
DIPARTIMENTO DI FISICA "Ettore Pancini" , Complesso Universitario di Monte S. Angelo, Edificio G,

SUMMARY OF PUBLICATION INDEXES

NUMERO DI PUBBLICAZIONI E CITAZIONI
Pubblicazioni in Riviste Scientifiche (Scopus/Web Of Science): 312/320
Citazioni Totali (Scopus/Web of Science): 23221/22092
Citationi/pubblicazione (Scopus/Web of Science): 74.18/69.03
H_index = (Scopus/Web of Science): 63/60
H_index Normalizzato (Scopus/ Web of Science) = 2.33/2.22 (Nb: the Academic life starts from the first paper ever published)

SUMMARY OF THE SCIENTUC ACTIVITY

The scientific activity of E. Calloni can be divided into two main themes: 1) gravitational waves search and observations, and 2) interaction of quantum vacuum flyctuations with gravity

1a) Direct contribution to gravitational wave search and detection. Contributions to the realization of the gravitational wave detector Virgo, with particular reference to seismic attenuation, optics, and commissioning of the interferometer: in the case of Virgo, it should be emphasized that Calloni has been for more than three years COMMISSIONING COORDINATOR, covering one of the key roles Experiment.
1b) Contribution to the design, experimental research and development for the Einstein Telescope. Measurement of seismic noise in the Sos Enattos site, design of Einstein Telescope optical layout in the 2L configuration, realizationa of high sensitivity titlmeters and contribution to R&D on suspensions.

2) Interaction gravity-vacuum fluctuations, experiments on vacuum fluctuations and phase transitions. In this field, Calloni has been PI of the INFN Aladin experiment for the measurement of the dependence of superconductor transition energy from vacuum fluctuations, and is currently PI of the INFN Archimedes experiment, aimed at verifying the questioned interaction of vacuum

fluctuations with gravity. Archimedes has been recently appointed as High Priority experiment in INFN-CNS2 for its intrinsic relevance and for its contribution to gravitational wave project ET.

PROJECTS LEADING

1999-2001 Scientific responsible for the construction of the "Departmental Facility for the Geometric stabilization of laser beams for very high precision optics" (Financing Department of Physics University Federico II of Naples)

2003-2004 Principal Investigator and Coordinator for the implementation of Adaptive Optics in Virgo (Financing EGO - European Gravitational Observatory - Participants: University Federico II - Côte d'Azur Observatory, France, Euro 50,000)

2005 - 2005 Principal Investigator and National Resp. experiment ALADIN (INFN Financing - Euro: 35,000).

2006-2008 Principal Investigator and National Representative ALADIN2 experiment (INFN Funding - Euro: 81,000).

2009-2010 Principal Investigator and National Representative of the Adv-ALADIN experiment (INFN Funding - Euro: 65,000).

2012 - 2016 Local Responsible for the Virgo and Adv-Virgo experiment (Financing INFN : Euro 337,500)

2012 - 2015 Head of the Federico II University Unit for the PRIN "Development of ultra low-loss optical interferometers for quantum noise reduction in gravitational wave detectors and ultra-sensitive detection of small forces in micromechanical systems. "MIUR funding : 103,500

2015 - 2017 Principal Investigator and National Resp. Archimedes experiment (INFN Group V Euro 95,500)

2017 - 2021 European Project Unit Manager H2020-MSCA-RISE-2016, "NEWS: NEw Windo wS on the universe and technological advancements from trilateral EU-US-Japan collaboration" - Funding unit Federico II, Euro 126.000

2018 - present Principal Investigator and National Resp. experiment Archimedes2 (INFN Group II funding to date: 1.1 Meuro

2019 - Head of PRIN Unit 'Characterization of the SOS-Enattos mine in Sardinia as the site for the Einstein Telescope GW observatory' 2017SYRTCN_003 - Funding MIUR Unit Federico II: 212,800

SCIENTIFIC COLLABORATIONS RESPONSIBILITIES AND POSITIONS

1) 1996 - today - Virgo and Advanced Virgo Experiment. Collaboration between various universities and research centers. Countries involved: Italy (INFN and various universities), France, Holland, Poland, Hungary. Since 2008 Virgo has signed and renewed every 3 years an agreement with LIGO (USA) for the research, detection and joint publication of gravitational wave signals.

Roles covered in the Virgo experiment:

1996 - 2006: construction and commissioning participation and co-responsibility for the local alignment, measurement of Super-Attenuators of seismic noise, simulation coupling laser fluctuations and interferometer imperfections.

2007-2008: Responsible for the optical characterization of the experiment

2008-2011: COMMISSIONING COORDINATOR : responsible for operation of the interferometer, the sensitivity achieved, the possible improvements, the organization and the planning of daily work and medium-term work. Responsible for organising the scientific runs VSR2, VSR3, VSR4.

2012 - 2016: responsible for the simulation of the control system project in Science Mode for Advanced Virgo

2012 - 2016: local INFN section manager of Naples
2012 - 2016: Member of the Virgo Steering Committee
2014 - 2015: co-organiser of the conferences called GWADW (Gravitational Waves Advanced Detectors Workshop)

2014 - today: member of the joint Virgo-LIGO committee called "Detection Committee" for the critical review, validation or disapproval of the first claims of revelation by a any analysis channel (this at the time of first detection) or new signals from sources detected for the first time (such as the 2017 neutron star collision)

2018 - today: commissioning participant and promoter of the use of tiltometers for Newtonian noise subtraction

2) 1999 - 2001 "Departmental Facility for the geometric stabilization of laser beams for high precision optics" (Financing Department of Physics University Federico II of Naples). Role held: Scientific Responsible

3) 2001-2009: Optics Adaptive for interferometry. Collaboration with the Naval Research Lab (USA) and the University New Mexico Istitute of Mining and Technology. Role: promoter of the collaboration. This collaboration also led to the bilateral collaboration agreement between Federico II University of Naples - New Mexico Institute of Technology, Socorro, USA. Role held: Adjunct Professor at the New Mexico Institute of Mining and Technology, and "University contact" for the University Federico II.

4) 2003-2004: Optics Adaptive for Virgo. R&D collaboration between the Department of Physical Sciences Federico II Naples and Observatoire de la Cote d'Azur (France) for the development of

original adaptive optics techniques for gravity wave interferometers. Role held: Principal Investigator and Coordinator

5) 2005: Aladin experiment collaboration between Naples INFN and IPHT (Jena -Germany) section, demonstrating the feasibility of an experiment to measure the contribution of vacuum fluctuations to condensation energy: Project Leader, National Responsible, Local Responsible

6) 2006-2008: Aladin2 experiment collaboration between Naples INFN and IPHT (Jena - Germany) for the measurement of the contribution effect of vacuum fluctuations to superconductive transition energy. Role covered: Project Leader and National and Local Manager

7) 2009-2010: ADV-Aladin Experiment: collaboration between Naples INFN and IPHT (JenaGermania) section for the further verification of the effect of vacuum fluctuations and superconductive transition energy. Role held: Project Leader and National Responsible

(8) 2013-2016 PRIN: Development of ultra low-loss optical weight interferometers for quantum noise reduction in gravitational wave detectors and ultra-sensitive detection of small forces in micromechanical systems. Experiment duration 3 years. Collaboration between various Italian Universities: Naples, Rome La Sapienza, Rome Tor Vergata, Perugia, Florence, Genoa, Pisa, Trento, Salerno, Urbino Role Covered: Head of Unit Naples Federico II.

9) 2015 - 2017 Archimedes Experiment: Collaboration between the INFN sections of Naples and Rome1 and Federico II University, Roma La Sapienza University, University of Marseille. Group V demonstrator of the feasibility of an experiment for the measurement of the "Archimedes vacuum thrust" or the interaction between gravity and quantum vacuum fluctuations. Duration of the experiment: 3 years. Role covered: Project Leader, National Responsible and Local Responsible.

10) 2018 - today: Archimedes Experiment2: experiment for the verification of the quantum vacuum gravity-fluctuation interaction. Collaboration INFN sections of Naples and Rome1, University Federico II, Rome La Sapienza, University of Sassari, EGO (European Gravitational Observatory), INO (National Institute of Optics). Expected duration of the experiment: 6 years. Role covered: Project Leader, National Manager and Local Manager.

(11) 2019 - 2022 PRIN: 'Characterization of the SOS-Enattos mine in Sardinia as the site for the Einstein Telescope GW observatory' - PRIN for the study of the Sos-Enattos (Nuoro) site as the site for the third-generation gravitational wave interferometer ET. Collaboration University Federico II, University of Sassari, GSSI (Gran Sasso Science Institute) and INFN Naples section. Role Covered: Head of Unit Naples Federico II.

12) 2018 - today: SAR-GRAV Consortium (Sardinia Underground Gravitational Laboratory) for the construction of the first low seismic noise laboratory in Italy at Sos-Enattos site. Participating Bodies: Sardinia Region, University of Sassari, INFN and INGV. Role: Promoter and Manager of the first experiment that will be installed there (Archimedes).

NATIONAL AND INTERNATIONAL AWARDS AND RECOGNITIONS FOR RESEARCH ACTIVITIES;

2017: Columbus Prize (as member of Virgo collaboration) from Rotary Club Firenze EST

2017: Murat Prize (as member of Virgo-Napoli) from Osservatorio Astronomico Capodimonte

2016: Cittadinanza Onoraria Per Meriti Scientifici from Municipality of Camaiore (LU)

2016: Gruber Cosmology Prize http:\\Gruber.Yale.edu\LIGO-Team-member

2016: Breakthrough Prize In Fundamental Physics, Awarded For Detection Of Gravitational Waves, https://breakthroughprize.org/News/32, (as member of LIGO-Virgo collaboration) -USA

2006: Aladin Experiment awarded as Highlight in INFN – section V: Technological Physics

TEACHING ACTIVITIES

1) Academic years 1996-97, 1997-98, 1998-99: the teaching activity focused on the assistance to the Physics Laboratory for Biological Sciences courses of the Degree Course in Biological Sciences. Every year Dr. Calloni was responsible for the development of the laboratory instrumentation and followed the exercises of the 3 courses. In particular, he oversaw the realization of the multimedia section of the laboratory, currently composed of networked computers and connected by video and monitors in various points of the laboratory. He also followed the development of the parts related to optical microscopy and linear optics.

2) Academic year 1999-2000:

2.1) Physics Course of the Degree Diploma in Chemical-Biological Analysis (Faculty of Mathematical, Physical and Natural Sciences)
2.2) Physics Course of the Degree Course in Biological Sciences.
2.3) Assistance of the 3 Physics Laboratory courses for Biological Sciences

3)
Academic year 2000-2001:
3.1) Physics Course for Diploma in Marine Production Biology
3.2) Physics Laboratory Course for Diploma in Marine Production Biology
3.3) Assistance to a Physics Laboratory course for Biological Sciences

3.4) He contributed, during the academic years 2000-2001 and 2001-2002, to the creation of a Physics Laboratory for the degree course in Marine Production Biology set up in the premises of ITN in Torre del Greco.

4) Academic year 2001-2002:
4.1) Physics Course for the Degree Course in Marine Production Biology
4.2) Physics Laboratory Course for the same degree course.
4.3) Course of Computer Science Elements for the same degree course

5)
Academic year 2002-2003:
5.1) Physics Course for the Degree Course in Marine Production Biology
5.2) Physics Laboratory Course for the same Degree Course)

6)
Academic year 2003-2004:
6.1) Physics course for the degree course in Marine Production Biology
6.2) Physics Laboratory Course for the same Degree Course

7)
Academic year 2004-2005:
7.1) Physics course for the degree course in Marine Production Biology
7.2) Physics Laboratory Course for the same Degree Course

8) Academic Year 2005-2006: Course of Physical-Environmental Models for the Master's Degree Course in Aquatic Systems Biology

9) Academic Year 2006-2007: Course of Physical-Environmental Models for the Master's Degree Course in Aquatic Systems Biology

10) Academic year 2007-2008:
10.1) Course of Physical-Environmental Models for the Master's Degree Course in Aquatic Systems Biology
10.2) Laboratory Course of Astrophysics II for the Master's Degree Course in Astrophysics and Space Science

Note: in the academic year 2008-2009, from 01.11.2008 to 31.10.2009, Dr. Calloni took a leave for study reasons motivated by the activity of Commissioning Coordinator of Virgo

11) Academic year 2009-2010:
11.1) Course of Experimental Gravitation Physics for the Master's Degree Course in Astrophysics and Space Science

12) Academic year 2010-2011
12.1) Systems Theory and Control Theory Course for the Master's Degree Course in Computer Science

13) Academic year 2011-2012
13.1) Systems Theory and Control Theory Course for the Master's Degree Course in Computer Science
13.2) Course of Experimental Gravitation Physics for the Master's Degree Course in Physics

14) Academic year 2012-2013
14.1) Systems and Control Theory Course for the Master's Degree Course in Computer Science
14.2) Course of Experimental Gravitation Physics for the Master's Degree Course in Physics

15) Academic year 2013-2014
15.1) Course of Experimental Gravitation Physics for the Master's Degree Course in Physics

16) Academic year 2014-2015
16.1) General Physics 1 course (module of 6 credits) for the Mechanical Engineering degree course
16.2) Course of Experimental Gravitation Physics for the Master's Degree Course in Physics

17) Academic year 2015-2016
17.1) General Physics 1 course (module of 6 credits) for the Mechanical Engineering Degree Course
17.2) Course of Experimental Gravitation Physics for the Master's Degree Course in Physics

(18) Academic year 2016-2017
18.1) General Physics 1 course (module of 6 credits) for the Mechanical Engineering degree course
18.2) Course of Experimental Gravitation Physics for the Master's Degree Course in Physics

19) Academic year 2017-2018
19.1) General Physics 1 course (module of 6 credits) for the Mechanical Engineering Degree Course
19.2) Course of Experimental Gravitation Physics for the Master's Degree Course in Physics

20) Academic year 2018-2019
20.1) General Physics 1 course (module of 6 credits) for the Mechanical Engineering Degree Course

21) Academic year 2020-2021
21.1) General Physics 1 course (module of 6 credits) for the Mechanical Engineering degree course

22) Academic year 2021-2022
22.1) General Physics 1I course (module of 6 credits) for the Mechanical Engineering degree course
22.1) General Physics 1 course (module of 6 credits) for the Optics and Optometric course

23) Academic year 2022-2023
23.1) General Physics 1I course (module of 6 credits) for the Mechanical Engineering degree course
23.1) General Physics 1 course (module of 6 credits) for the Optics and Optometric course

24) Academic year 2024-2025
24.1) General Physics 1 course (module of 9 credits) for the Mechanical Engineering degree course
24.1) Experimental Gravitational Physics course 9 credits

PHYSICS THESIS SUPERVISOR

1) Errico Luciano, Interaction of quantum Vacuum Fluctuations and gravity: the Archimedes Experiment (Tesi magistrale, 2018)

2) Sequino, Valeria Low frequency analysis of Virgo 2012 gravitational antenna data (Magistral Thesis)

3) Allocca, Annalisa Influence of vacuum fluctuations in superconductive phase transitions: the ALADIN experiment (2011 Magistral Thesis)

4) Allocca, Annalisa Fluttuazioni di vuoto e transizioni di fase: misure preliminari all'esperimento ADVALADIN Calloni, Enrico 23 ottobre (2008 triennale tesi)

5) Scaldaferri, Ornella Dimensionamento e misura della sensibilità dell'esperimento Aladin per la rivelazione della prima transizione di fase influenzata dalle fluctuazioni di vuoto (2005 Tesi Magistrale)

6) Tierno, Alessio Il problema delle fluttuazioni geometriche del laser di Virgo: analisi dei noori e possibile utilizzo di ottica adattiva (2004 Tesi Magistrale)

7) Avino, Saverio Adaptive control of laser beams for gravitational wave detectors, (2003 Tesi Magistrale)

Supervisor of the following PhD thesis in Physics

1) Errico Luciano From Archimedes to ET: Vacuum fluctuations and gravity interaction, Newtonian Noise in Virgo and the study of ET site (Provisional title, to de discussed in 2021)

2) Parisi, Maria (2011) Mitigation of Laser Beam Perturbations in the Virgo and Advanced-Virgo Gravitational Waves Detectors.

3) Avino, Saverio (2007) Adaptive optics techniques for gravitational wave interferometers.

Post-doctorate

1) Scientific responsible for the three-year research grant (PRIN domain): 'Contribution for the realization of ultra lowloss optical interferometers in weighting regime for the reduction of quantum noise in gravitational wave detectors' - Assigned to Dr.: Martina De Laurentis

25) EDUCATIONAL ACTIVITIES ABROAD

25.1) Academic Years 2005-2006, 2006-2007- 2007-2008 - 2011-2012 and 2012-2013: Faculty Adjunt (Adjunct Professor) at the New Mexico Institute of Mining and Technology (USA) in the Department of Electronic Engineering

25.2) Academic Year 2008-2009: Maitre de Stage de Bonnand Romain for the "Master 2 " Optique, Image et Vision ", spécialité professionelle " Instrumentation Optique, Contrôle et Vision ",

Université Jean Monnet, Saint-Etienne (France). Thesis entitled: Caractérisation Optique du détecteur d'ondes gravitationnelles Virgo

COMMITMENTS UNDERTAKEN IN COLLEGIAL BODIES, COMMISSIONS AND DEPARTMENTAL COUNCILS OF THE UNIVERSITY, MINISTRY OF EDUCATION, ITALIAN OR FOREGNEIRS ISTITUTIONS OF SC IENTIFIC RESEARCH

1) 2018 - 2020: Institution: Department of Physics University Federico II - Role: Coordinator Teachers of General Physics Teaching 1 at the Degree Course in Mechanical and Aerospace Engineering

2) 2018 - 2021: Institution: Department of Physics University Federico II - Role: Coordinator of the Astroparticle Section

3) 2018 - Institution: Department of Physics University Federico II - Member of Commission for evaluation from RTDb to Second Band Professor Dr. Laura Valore

4) 2017 - Institution: Department of Physics University Federico II - Member of Commission for RTDa competitions, code RTD04A2017 (area 02/A1 FIS01), and code 2_RTDA_2017_23 (area 02/A1 FIS01).

5) 2013 -- 2018 (A.A 2014/15) to 2018 (A.Y. 2018/19) - Institution: Department of Physics University Federico II - Member of the Doctoral College in Physics - cycles from XXIX to XXXIV

6) 2007 - today: Institution: Federico II University - Department of Physics - Role: RADoR (Responsible for Teaching or Research Activities) for the Organization and Prevention of the Laboratory of Adaptive Optics of the Department of Physics (a part of the Laboratory of Physics of Gravitation - former Virgo laboratory)

7) 2004 - 2005: Institution: Federico II University - Department of Physics - Role in charge of the Ecology Service of the Department of Physical Sciences

8) 2001 - 2008 Federico II University : Member of the Degree Course Council (CCL) and then Course Council (CCS) of Marine Biology Studies.

9) 2017 - Institution: Physics Department University of Pisa - Role: External Commissioner (Counter-Rollator) Final PhD Examination in Physics, Candidate Dr. Guido Cerretani
10) 2017 - Institution: University of Ferrara - Role: External Commissioner (Counter-Rollator) Final PhD Examination in Physics, Candidate Dr. Aldo Ejlli

11) 2015 - Institution: Department of Experimental Physics University of Siena - Role: External Commissioner (Counter-Rollator) Final PhD Examination in Physics, Candidate Dr. Annalisa Allocca

12) 2016 - Institution: University of Rome Tor Vergata - Role: External Commissioner (Counter-Relator) Final PhD Examination in Physics, Candidate Dr. Valeria Sequino

13) 2007 - Institution: Department of Experimental Physics University of Siena - Role: Member of the Judging Committee Final Examination of Doctorate in Physics

(14) 2018 - 2018 Establishment: Deutsche Forschungsgemeinschaft (Germany) - Role: Member of the Review Panel for Deutsche Forschungsgemeinschaft (Germany) for the 'Excellence Strategy by the German Federal and State Governments to Promote' - P11 Natural Science - Required Funding 33.9 Million Euro

(15) 2017 - 2017 Establishment: Deutsche Forschungsgemeinschaft (Germany) - Role: Member of the Review Panel for Deutsche Forschungsgemeinschaft (Germany) for the Collaborative Research Centre (CRC) 1128 'Relativistic Geodesy and Gravimetry with Quantum Sensors - Modelling, Geo-Metrology, and Future Technology' Requested Fundings: 22.4 Millions Euro

16) 2012/13 -- Institution: MIUR - Role: PRIN Projects Reviewer

17) 2013 - Institution: MIUR - Role: FIRB Project Reviewer

18) 2013 -- 2016 - Institution: INFN -- Role: External Auditor CSN5 Projects

19) 2020 - DFG - Deutsche Forschungsgemeinschaft: member of Review panel, Germany - Funding request: 0.6 Meuro

20) 2024 - DFG - Deutsche Forschungsgemeinschaft: member of Review panel, Germany - Funding request: 16.4 Meuro

21) 2025 - DFG - Deutsche Forschungsgemeinschaft: member of Review panel, Germany - Funding request: 11.3 Meuro

Firma: Enrico Calloni