



Curriculum Vitae et Studiorum

Matteo Lorenzini

Email: matteo.lorenzini77@gmail.com

Tel: ++39 3332815470

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Place and date of birth: Firenze (Italy), April 9th 1977

Driving licence: A, B and sailing licence.

About me: I am married and father of two. Currently I live close to Rome, in the Castelli area. My interests include science, archaeology, event planning, writing, gaming, travels and fine arts. As side activities, I write novels, I am a leading member a cultural association devoted to education, I am used to organize creativeness workshops within the community of friends on an annual basis. I am also intrigued by fundamental epistemological problems such as complexity and consciousness.

Education and Positions

2019-	Research fellow (RTDa) at the Dipartimento di Fisica dell'Università di Roma Tor Vergata.
2018-	Visiting scientist at the Gran Sasso Science Institute, Astroparticle group, on the advanced interferometric detectors of gravitational waves.
2014-2018	Postdoctoral position at the Gran Sasso Science Institute, Astroparticle group, on the advanced interferometric detectors of gravitational waves.
2013-2014	Postdoctoral fellowship (seconda fascia, ex art. 22 legge 240/2010) at the Virgo group of the University of Roma Tor Vergata.
2012-2013	Postdoctoral fellowship (prima fascia, ex art. 22 legge 240/2010) at the Virgo group of the University of Roma Tor Vergata.
2011	Research scholarship at the CGWA, University of Texas at Brownsville (US)
2009-2011	Postdoctoral fellowship at the Virgo group of INFN Firenze, funded by the European project "Einstein Gravitational Wave Telescope" under the Grant Agreement FP7-211743
2008-2009	Collaboration with the LISA groups in Firenze and Tor Vergata, under fixed term research contracts.
2008	PhD in Astronomy at the Astronomy and Space Science Department of the University of Florence with the thesis <i>Suspension thermal noise issues for advanced GW interferometric detectors</i> , dedicated to the R&D activity on thermal noise reduction for the next generations of GW interferometric detectors. Advisors:

May-June 2005	prof. R. Stanga and dr. G. Losurdo. Visiting student at the University of Glasgow – IGR group with prof. G. Cagnoli and prof. J. Hough.
2004	Master degree in physics with a thesis on the thermal noise of mirror suspensions in gravitational wave interferometric detectors, devoted to the measurement of mechanical losses in innovative wire suspensions. The thesis was approved with 106/110 on July, 20th. Advisor: prof. R. Stanga.
1991-1996	Classical Studies at Liceo Ginnasio Galileo, Firenze (Italy) with diploma score 54/60.

Research activities

	My activity is focused on experimental aspects of the detection of gravitational waves, optics and material science. I worked alternately within the Virgo, LIGO and LISA collaborations.
2004-2011	My research interest was initially devoted to the R&D for the reduction of thermal noise for the advanced GW interferometric detectors. I worked at the INFN Virgo laboratory in Firenze, studying the thermomechanical properties of low loss materials (mainly silicon and fused silica, both at room and cryogenic temperatures) and the feasibility of innovative techniques such as silicate bonding. At the beginning of my PhD, I demonstrated the feasibility of loss angle measurements on brittle poly-crystalline silicon fibres with a particular clamping method. One of the main outcomes of my work in this field is the installation of monolithic fused silica suspensions in the Virgo+ interferometer , improving the low frequency sensitivity of the original Virgo. I was responsible for the production and characterization of silica fibres installed in the quasi-monolithic Virgo+ suspension. During this period I had a tight collaboration with the IGR group from the University of Glasgow, and I took part in the development of the design study document of the 3 rd generation ET detector. My experimental work also encompassed the optical and mechanical study of highly performing multi-layered coatings, and I contributed with dr. E. Cesarini to the development of the innovative GeNS measurement method devised by prof. G. Cagnoli, now adopted worldwide for the characterization of advanced coatings. In parallel, I collaborated to the construction of the double-pendulum facility for the Earth-based test of LISA pathfinder technology, under the advice of prof. M. Bassan. In the general framework of thermal noise reduction technology, I spent few months as visiting scientist at the CGWA of the University of Texas at Brownsville (LIGO side), where I helped in setting up a laboratory for the measurement of creep noise in fully monolithic fused silica suspensions. Being most of the time part of the Virgo-LIGO collaboration, I took part as scientist to the shifts scheduled for the observational runs.
2012-2018	After the visiting period at CGWA, I came back to Italy and entered a new field of research, i.e. the detection and active correction of wavefront aberrations in highly sensitive optical systems. My work is included in the collaborative effort to upgrade Virgo to the second generation Advanced Virgo detector, designed to have a 10 times higher sensitivity, that is, a volume of accessible Universe 1000 times larger. Since 2012 I am part of the Virgo INFN Tor Vergata group led by prof. V. Fafone, that is responsible for the thermal compensation system (TCS) , a vital item in the core of the Advanced Virgo upgrade: the TCS sub-system is critical in keeping the detector in operation, when the optical power in the interferometer reaches the astonishing values of order of MW. The system is able to perform a very accurate assessment of the wavefront distortion and to correct for it via several parallelized actuators, using monochromatic and thermal radiation. The TCS sub-system is now

in a commissioning phase within the global Advanced Virgo installation and I am directly involved in the on-site work since the installation. I contributed to all the aspects of the activity: among other things, I designed part of the CO₂ projectors for thermal actuation, and I am currently responsible for the CO₂ projectors installed in Advanced Virgo. I provided the theoretical framework for the computation of the aberrated wavefront in core optics from the wavefront measurement on sensors.

In view of the future development of gravitational wave astronomy, many technologies still require dedicated research efforts. This is why I am still working on R&D, both in the innovation of TCS techniques (deformable mirrors can be used as an upgrade of developed strategies) and exploring other lines, particularly in the field of **coating research** that recently received a boost worldwide, still being a fundamental limit to many cutting-edge applications. In this respect, I took part in the CSN V project AdCoat for the study of nano-layered coatings, and I collaborate on a regular basis to theoretical and experimental issues with colleagues from Italian, German and French laboratories, mainly within the VCR&D collaboration. I gave several original contributions to the field. I modeled the mode-dependent loss in silica discs as the effect of extra loss in the barrel unpolished surface and I suggested a CO₂ laser polishing to remove this spurious effect. This procedure has been recently proved on silica samples by me and colleagues. I also studied the origin of a similar branching in silicon discs, proving that it is due to thermoelastic dissipations. I signed, as many other colleagues, a letter of intent to join the future effort toward the third generation European detector **Einstein Telescope**.

Part of my research activity has been devoted to the design and construction of a cryostat for the characterization of flying parts for the experiment **LSPE**. Recently, I started applying my expertise to the problem of **adaptive mode matching** for the injection of squeezed light in GW detectors.

I may add to this portrait of research activities some academic record: in the last few years I had the occasion to take part in the teaching of the courses of General Physics I and II at the University of Roma Tor Vergata, and I give lectures on thermal noise as part of the course on Gravitational Waves.

Since 2014, I have a position at the **Gran Sasso Science Institute** while my experimental activity is still performed in the Tor Vergata lab and at the Advanced Virgo site. I am a member of the astroparticle group, led by prof. M. Branchesi, under the advice of prof. F. Vissani and prof. E. Coccia. I am also part of the teacher board of PhD courses at GSSI, with a course on strategies for the correction of aberrations in high sensitivity optical systems.

During my career, I signed more than 240 papers, part of them as member of the Virgo collaboration and, subsequently, of the LIGO-Virgo collaboration: my H-index is 73 (Scopus). A selection of papers, together with a list of attended conferences and schools, talks and posters, is reported at the end of this CV.

Prizes and awards

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| 2007 | GWIC Thesis Prize honorable mention
INFN Bruno Rossi Prize honorable mention |
| 2016 | Award for scientific merit conferred by the Chancellor of Università degli Studi di Roma Tor Vergata
Breakthrough Prize in fundamental physics, awarded for detection of gravitational waves
Gruber Cosmology Prize, awarded for detection of gravitational waves |
| 2017 | Einstein Medal, awarded for the detection of gravitational waves |

Teaching experiences

2011	During my visit to the CGWA at the University of Texas at Brownsville, I gave lectures in the physics class of prof. G. Cagnoli
2012-2015	Course on Electromagnetism and Optics for the Media Science and technology curriculum at the Mathematics, Physics and Natural Sciences Faculty (SMFN), Università di Roma Tor Vergata.
2015-2020	Course on Mechanics/Thermodynamics for the Physics curriculum at the SMNF, Università di Roma Tor Vergata.
2016-	Lectures on thermal noise during the course on Gravitational Waves for the Physics curriculum at the SMNF, Università di Roma Tor Vergata.
2018-2019	Course on strategies for the correction of aberrations in high sensitivity optical systems for the PhD students at GSSI.
2020-	Course on Experimental Mechanics/Thermodynamics/Electromagnetism and Optics for the Physics curriculum at the SMNF, Università di Roma Tor Vergata.
2020-	Laboratory of Fundamental Interactions for the Physics curriculum at the SMNF, Università di Roma Tor Vergata.

Supervision of students

2012-	As a relevant part of my educational activity, I supervised graduate students and PhD students involved in my field of research. Particularly, I have been up to now involved in the supervision of the work of bachelor's, master's degree and PhD students from different institutions (GSSI, Università di Roma Tor Vergata, Università di Roma La Sapienza). I also had been supervisor of summer students in the INFN- U.S. DOE exchange program.
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Outreach

	Within my education program, I gave support to dissemination activities for high schools and I presented public lectures and experimental demonstrations; my commitment in science communication continued and, as the first detection of gravitational waves was announced in 2016, I had many occasions to present in public my work and explain the wonderful physics involved in the generation and detection of gravitational waves. In the last years, I also personally offered guided tours to the Advanced Virgo site, for high school groups or individuals.
2006-2008	As part of the Open Lab project of the University of Firenze, I was involved in the explanation of fundamental physics for high school students, through guided lab experiences on a monthly basis. Once per year, with few colleagues I was responsible of the organization of the demonstrations of Aerodynamics in the context of ScienzEstate fair at the Science Faculty of the University of Firenze.
2010	Invited talk <i>Onde gravitazionali: una sfida ancora aperta</i> during the Notte Blu science fair, Firenze
2016	Talk <i>GW150914: una nuova finestra sul cosmo, la rivelazione delle onde gravitazionali</i> , at Istituto Cavanis high school, Roma Public talk <i>Qualcosa è cambiato: la rivelazione delle onde gravitazionali</i> , with dr. Elisabetta Cesarini and dr. Giulietta Gheller, Rest Art Rome, Roma, in collaboration with Centro Culturale Roma http://www.centroculturaleroma.org/ Invited seminar <i>La rivelazione delle onde gravitazionali</i> , Liceo Scientifico G.

- Pellecchia, Cassino
Public talk *Qualcosa è cambiato: la rivelazione delle onde gravitazionali*, with dr. Elisabetta Cesarini and dr. Giulietta Gheller, Library of Impruneta, Firenze
- 2017- Invited seminar *La rivelazione delle onde gravitazionali*, with prof. R. Stanga, ISIS Leonardo da Vinci, Firenze
Training course *Incontri di Fisica* for teachers, INFN Labs Frascati, Rome
Scienza Orienta initiative for high schools, at the SMFN macroarea of Università di Roma Tor Vergata.

Skills

Responsibilities

- 2009-2010 Responsible of the production and validation of the silica wires for the integration in the quasi-monolithic payload for Virgo+
- 2012-2014 Responsible of the characterization and validation of the CO2 laser sources for the Thermal Compensation System in Advanced Virgo
- 2014-2018 Responsible of installation and commissioning of the CO2 projectors for the Thermal Compensation System in Advanced Virgo
- 2019 Responsible for the research line on metrology, within the VCR&D collaboration of Advanced Virgo
- 2021 Deputy sub-system manager of the TCS of Advanced Virgo Plus, responsible for the Phase II preparation.

Languages

Mother tongue: **Italian**
Other Languages: **English**, basic French



Appendix A: Selected papers

- M. Alshourbagy et al., *Measurement of the thermoelastic properties of crystalline Si fibres*, CLASSICAL AND QUANTUM GRAVITY (2006) , vol. 23, 8, S277-S285
- M Alshourbagy et al., *First characterization of silicon crystalline fibers produced with the mu-pulling technique for future GW detectors*, REVIEW OF SCI. INSTRUM. (2006), vol. 77, 044502
- M. Lorenzini et al., *Thermomechanical characterization of materials for future interferometric GW detectors* in XLII RENCONTRES DE MORIOND PROCEEDINGS (2007).
- B. P. Abbott et al., *An upper limit on the stochastic gravitational-wave background of cosmological origin*, NATURE (2009) , vol.460, 7258, 990-994
- E. Cesarini et al., *A gentle nodal suspension for measurements of the acoustic attenuation in materials*, REVIEW OF SCI. INSTRUM. (2009) , vol.80, 5
- M. Lorenzini et al., *Silicate bonding properties: investigation through thermal conductivity measurements*, J. PHYS. CONF. SER. (2010), vol. 228, 012019
- E. Cesarini et al., *Mechanical characterization of uncoated and Ta2O5-single-layer-coated SiO2 substrates: results from GeNS suspension and the CoaCh project*, CLASSICAL AND QUANTUM GRAVITY (2010), vol. 27, 084031
- F. Piergiovanni et al., *The dynamics of monolithic suspensions for advanced detectors: a 3-segment model*, J. PHYS. CONF. SER. (2010), vol. 228, 012017
- L. Marconi et al., *The 2 Degrees of Freedom facility in Firenze for the study of weak forces*, J. PHYS. CONF. SER. (2010), vol. 228, 012037
- M. Prato et al., *Multitechnique investigation of Ta2O5 films on SiO2 substrates: comparison of optical, chemical and morphological properties*, J. PHYS. CONF. SER. (2010), vol. 228, 012020
- M. Lorenzini, *Suspension thermal noise issues for advanced gravitational waves interferometric detectors*, NUOVO CIMENTO B (2010), vol. 125, n. 1, 89-108
- M. Punturo et al., *The third generation of gravitational wave observatories and their science reach*, CLASSICAL AND QUANTUM GRAVITY (2010), vol. 27, 084007
- M. Punturo et al., *The Einstein Telescope: a third-generation gravitational wave observatory*, CLASSICAL AND QUANTUM GRAVITY (2010) , vol.27, 19
- M. Lorenzini for the Virgo Collaboration, *The monolithic suspension for the Virgo interferometer*, CLASSICAL AND QUANTUM GRAVITY (2010) , vol.27, 8
- E. Cesarini et al., *Silica as a key material for advanced gravitational wave detectors*, JOURNAL OF NON-CRYSTALLINE SOLIDS (2011), vol. 357, 2005-2009
- T. Accadia et al., *A thermal compensation system for the gravitational wave detector Virgo*, PROCEEDINGS OF THE 12th MARCEL GROSSMAN MEETING (2011)

- M. Lorenzini et al., *A tool for measuring bending length in thin wires*, REVIEW OF SCI. INSTRUM. (2013), vol. 84, 033904
- E. Cesarini, G. Cagnoli, M. Lorenzini and F. Piergiovanni, *A gentle nodal suspension for measurements of the acoustic attenuation in material*, METROLOGY FOR AEROSPACE IEEE PROCEEDINGS (2014)
- F. Acernese et al., *Advanced Virgo: a second-generation interferometric gravitational wave detector*, CLASSICAL AND QUANTUM GRAVITY (2015) , vol.32, 2
- B. P. Abbott et al., *Observation of Gravitational Waves from a Binary Black Hole Merger*, PHYSICAL REVIEW LETTERS (2016) , vol.116, 6
- B. P. Abbott et al., *GW151226: Observation of Gravitational Waves from a 22-Solar-Mass Binary Black Hole Coalescence*, PHYSICAL REVIEW LETTERS (2016) , vol.116, 24
- B. P. Abbott et al., *Astrophysical implications of the binary black hole merger GW150914*, ASTROPHYSICAL JOURNAL LETTERS (2016) , vol.818, 2
- B. P. Abbott et al., *Multi-messenger observations of a binary neutron star merger*, ASTROPHYSICAL JOURNAL LETTERS (2017) , vol. 848, 2
- B. P. Abbott et al., *GW170817: Observation of gravitational waves from a binary neutron star inspiral*, PHYSICAL REVIEW LETTERS (2017) , vol.119, 16
- B. P. Abbott et al., *GW170104: Observation of a 50-Solar-Mass Binary Black Hole Coalescence at Redshift 0.2*, PHYSICAL REVIEW LETTERS (2017) , vol.118, 22
- B. P. Abbott et al., *GW170814: A Three-Detector Observation of Gravitational Waves from a Binary Black Hole Coalescence*, PHYSICAL REVIEW LETTERS (2017) , vol.119, 14
- B. P. Abbott et al., *A gravitational-wave standard siren measurement of the Hubble constant*, NATURE (2017) , vol. 551, 85-88
- G. Cagnoli, M. Lorenzini et al., *Mode-dependent mechanical losses in disc resonators*, PHYSICS LETTERS A (2018), vol. 382, issue 33
- M. Lorenzini et al, *Adaptive optics methods in gravitational wave interferometric detectors, a perspective*, submitted to GRASS 18 – Proceedings of Science (2018)
- E. Cesarini, M. Lorenzini et al, *The Virgo Coating Collaboration: a detailed study on thermoelasticity in crystalline materials and other research lines*, submitted to GRASS 18 – Proceedings of Science (2018)

Appendix B: Conferences and schools

As chair/organizer	<ul style="list-style-type: none"> • <u>IAPS @ Gran Sasso</u> - Particle & Astroparticle Physics Spring Event (GSSI L'Aquila, Italy, May 8th 2015) • <u>Thermal Noise: Open Problems Workshop</u> (Roma Tor Vergata, Italy, April 16th – 17th 2015)
As speaker	<ul style="list-style-type: none"> • <u>GWADW 2019</u> –(Isola d'Elba, Italy, May 19th-25th, 2019) <ul style="list-style-type: none"> ✓ Talk <i>Coating thermal noise in Adv+</i> • <u>GRASS 18</u> - Adaptive optics methods in GW interferometric detectors, a perspective (Padova, Italy, March 1st - 2nd 2018) • <u>GWADW2016</u> - Impact of Recent Discoveries on Future Detector Design (Isola d'Elba (LI), Italy, May 22nd -28th 2016) <ul style="list-style-type: none"> ✓ Talk <i>Modelling of the mode-dependent mechanical losses in disc substrates</i> • <u>1st Physics Fair at GSSI</u> (L'Aquila, Italy, November 3rd to 6th 2015) <ul style="list-style-type: none"> ✓ Talk <i>The direct detection of Gravitational Waves</i> • <u>XCIX Congresso della Società Italiana di Fisica</u> "SIF 2013 " (Trieste, Italy, September 23-27th 2013) <ul style="list-style-type: none"> ✓ Talk as invited speaker <i>From Virgo to Advanced Virgo: a step forward in the detection of gravitational waves</i> • <u>ET WP2-WP3 Joint Meeting</u> (Jena, Germany, March 1st-3rd 2010) <ul style="list-style-type: none"> ✓ Talk <i>Thermal noise R&D in Firenze - cryogenic measurements</i> • <u>8th Edoardo Amaldi Conference</u> on Gravitational Waves (New York (USA), June 21-26th 2009) <ul style="list-style-type: none"> ✓ Talk <i>The monolithic suspension for the interferometer Virgo</i> ✓ Poster <i>Double degree of freedom pendulum facility for the study of weak forces</i> ✓ Poster <i>Mechanical characterization of uncoated and Ta2O5-single-layer-coated SiO2 substrates: results from GeNS suspension and the CoaCh project</i> ✓ Poster <i>Properties of hydroxyl-catalysis bond for use in advanced gravitational wave detectors</i> ✓ Poster <i>Silicate bonding properties: investigation through thermal conductivity measurements</i> ✓ Poster <i>The dynamics of monolithic suspensions for advanced detectors: a 3-segment model</i> • <u>XLII Rencontres de Moriond</u> (La Thuile (AO), Italy, March 11-18th 2007) <ul style="list-style-type: none"> ✓ Talk <i>Thermomechanical characterization of materials for future interferometric GW detectors</i> • <u>XCI Congresso della Società Italiana di Fisica</u> "SIF 2005 " (Catania, Italy, September 26-30th 2005) <ul style="list-style-type: none"> ✓ Talk <i>Measurement of thermoelastic properties of crystalline silicon fibres</i>
As participant	<ul style="list-style-type: none"> • <u>8th ET Symposium</u> (Birmingham, March 27th to 28th 2017) • <u>7th ET Symposium</u> (Firenze, Italy, February 2nd to 3rd 2016) • <u>1st International IEEE Workshop</u> on Metrology for Aerospace (Benevento, Italy, May 29th – 30th 2014) • <u>5th ET Symposium</u> (Hanover, Germany, October 22nd -23rd 2013) • <u>10th Edoardo Amaldi Conference</u> on Gravitational Waves (Warsaw (PL), July 7th - 13th 2013) <ul style="list-style-type: none"> ✓ Poster <i>Thermal compensation system for non symmetric optical distortions in future gravitational wave detectors</i> ✓ Poster <i>Characterization of the Lasy-50 Co2 laser to be used in the Advanced Virgo TCS</i>

- GWADW Meeting (Isola d'Elba (LI), Italy, May 19th -25th 2013)
 - 4th ET Symposium (Hanover, Germany, December 4th -5th 2012)
 - GWADW Meeting (Isola d'Elba (LI), Italy, May 22nd -28th 2011)
 - 3rd ET Annual Meeting (Budapest, Hungary, November 23th -24th 2010)
 - SiO₂ Advanced Dielectrics and Related Devices (Varenna, Italy, June 21st-24th 2010)
 - 2nd ET Annual Meeting (Erice (TP), Italy, October 14th -16th 2009)
 - ET WP2 Workshop (Roma, Italy, February 26th-27th 2009)
 - LIAS 6th Annual Meeting (Dresden, Germany, February 16th -19th 2009)
 - LIAS ET GWA Meeting (Cascina (PI), Italy, November 24th -26th 2008)
 - GWADW VESF Meeting (Isola d'Elba (LI), Italy, May 12th -18th 2008)
 - LSC-Virgo Meeting and Coating Workshop (Caltech (Pasadena, CA, USA), March 17th-22th 2008)
 - LI Congresso Nazionale Sait (Firenze, Italy, April 17-20th 2007)
 - ✓ Poster *A study on the thermomechanical characteristics of materials for future GW interferometric detectors*
 - LIGO-Virgo Thermal Noise Workshop (Cascina (PI), Italy, October 7th 2006)
 - XIII SIGRAV Graduate School on Experimental Gravitation in Space (Arcetri (FI), Italy, September 25-27th 2006)
 - GWADW VESF Meeting (Isola d'Elba (LI), Italy, May 27th - June 2nd 2006)
 - XIII SIGRAV, A century from Einstein Relativity: probing gravity theories in binary systems (Como, Italy, May 17-21th 2005)
 - 3rd VIRGO-EGO-SIGRAV School on Gravitational Waves (Cascina (PI), Italy, May 24-28th 2004)
 - 5th Edoardo Amaldi Conference on Gravitational Waves (Tirrenia (PI), Italy, July 6-11th 2003)
- Other talks/posters
- *Thermal conductivity measurements*, seminar as invited scientist at Jena University (December 11th, 2006)
 - *Bending point measurement machine*, talk at Virgo Week (Cascina (PI), Italy, September 10-12th, 2007)
 - *Thermal noise issues for future GW detectors: INFN Firenze-Urbino R&D activities, Part 1*, seminar as invited scientist at AEI Hannover (March 30th, 2011)
 - *AdV TCS*, talk at Virgo Week (Cascina (PI), Italy, January 28th, 2014)
 - *TCS status update*, talk at Virgo Week (Cascina (PI), Italy, December 10th, 2014)
 - *AdCoat update*, talk at Virgo Week (Cascina (PI), Italy, April 28th, 2015)
 - Poster *R&D activity on fibres* at the Amaldi 6, June 20-24th, 2005, Okinawa (Japan).
 - Poster *Studies of Bulk Silicon for Third Generation Gravitational Wave Detectors* at the Amaldi 7, Sidney, July 8-14th 2007.
 - Poster *Silicate bonding properties: investigation through thermal conductivity measurements*, at the LSC-Virgo Meeting, March 15-18th 2010, Arcadia (CA).
 - Poster *Creep rate measurement setups for the hydroxide-catalysis bonded silica ears*, at the 9th Amaldi Conference, July 10-15th 2011, Cardiff (UK).
 - Poster *Roma Tor Vergata test facility for the characterization of the Advanced Virgo TCS*, at the LSC-Virgo Meeting, March 17th - 21st 2014
 - Poster *A machine for the annealing of the barrel surface in fused silica discs to be used in coating characterization with GeNS*, at the LSC-Virgo Meeting, March 13th to 16th 2017, Pasadena
 - Poster *Correction of optical aberration: lessons from 2nd generation towards future detectors* at the 10th ET Symposium, 11th -12th April 2019, Orosei (Italy)