Curriculum Vitae of IGNAZIO CIUFOLINI

Università del Salento, Lecce, Italy and Centro Fermi, Rome, Italy

1. Summary

1980: **Laurea** in Mathematics, with thesis in gravitational physics (Magna cum Laude, i.e., with honours), Sapienza, University of Rome.

1984: **Ph.D.** in Physics, University of Texas at Austin (Ph.D committee*: John Archibald Wheeler, Richard Matzner, Steven Weinberg* (Nobel in Physics 1979)*, Bryce DeWitt, Larry Shepley*).

1981: Teaching Assistant, Physics Department, Montana State University, Bozeman, MT.

1982-1984: Teaching Assistant, Physics Department. University of Texas at Austin.

1984-1986: Lecturer (**Faculty member**) and Research Associate, Physics Department and Center for Theoretical Physics, University of Texas at Austin.

1986-1988: Research Associate (**Faculty member**), Center for Space Research University of Texas at Austin.

1989: Visiting Professor, Physics Department, University of Trento (Italy).

1989-1999: Research Associate, IFSI, CNR (National Research Council of Italy), Frascati (Rome).

1996-2008: Visiting Professor (Professore a Contratto), Scuola di Ingegneria Aerospaziale, Sapienza, University of Rome.

1999-present: Associate Professor of General Physics (Professore associato confermato), of "Fisica Sperimentale" FIS/01), University of Salento, Lecce.

2006: "Chiamata per chiara fama", i.e., full professorship for outstanding scientific achievements, by "Sapienza" University of Rome (not implemented for lack of funding).

2006-present: Director (with Richard Matzner) of the International School of Astrophysical Relativity "John Archibald Wheeler" (Ettore Majorana Centre, Exs4erice) and director (2006) of the first course on "Gravitational Waves, Frame-Dragging and Gravitational Tests".

2008-present: Principal Investigator for ASI of an advanced international center for high precision orbital determination and analysis of Earth satellites.

2009-present: Chairman of the International LARES Science Workshops: 2009, 2012, 2015 and 2019.

2011-2013: Principal Investigator of the Italian-German project "Space Tests of General RElativity Using GALileo Constellation (REGAL)", winner of a European Space Agency call for proposals.

2012-present: Member of the experts of Centro Fermi (Rome).

2014/present-Habilitation Full professor (Abilitazione Professore Ordinario) of "*Experimental Physics of Fundamental Interactions*" (FIS/01).

2014/present-Habilitation Full professor (Abilitazione Professore Ordinario) of "*Theoretical Physics of Fundamental Interactions*" (FIS/02).

2009-present: Principal Investigator of the *LARES (LAser RElativity Satellite)* satellite space experiment for the Italian Space Agency.

2017-present: Principal Investigator of the *LARES 2 (LAser RElativity Satellite 2)* satellite space experiment for the Italian Space Agency.

2. Selected Research and Coordinating Activities

1988-1998: Principal Investigator for PSN (Piano Spaziale Nazionale), Italian Space Agency and NASA (with B. Tapley) of the space project **LAGEOS III.**

1992: Member of the ESA-NASA **Sagittarius** space experiment working group for gravitational waves detection.

1993: Member of the ESA-NASA **OMEGA** (Orbiting Medium Explorer for Gravitational Astrophysics Space Experiment) space experiment working group for gravitational waves detection.

1994-1998: Member of the ESA **LISA** (Laser Inteferometer Space Antenna for gravitational waves) working group.

1993-1994 Member of the **ESA Fundamental Physics Working Group**.

1993-1994: Member (referee) of the International Science Foundation.

1996-2004 Member of **board of directors** (elected in 1996 and 2000) of the Italian Society for General Relativity and Gravitation (**SIGRAV**).

2001: **Chairman** of the XXV John Hopkins International Workshop on Current Problems in Particle Theory, dedicated to Theory and Experiments in General Relativity and Gravitational Physics, Florence, September 2001.

2006-present: **Director** (with Richard Matzner) of the **International School of Astrophysical Relativity "John Archibald Wheeler"** (Ettore Majorana Centre, Erice) and **director** (2006) of the first course on "Gravitational Waves, Frame-Dragging and Gravitational Tests".

2008-present: Principal Investigator for ASI of an advanced international center for high precision orbital determination and analysis of Earth satellites.

2009: **Chairman** of the First International LARES Science Workshop, Rome, July 2009.

2010-2018: Associate Editor of the European Physical Journal: EPJ Plus.

2011-2013: Principal Investigator of the Italian-German project "Space Tests of General RElativity Using GALileo Constellation (REGAL)", winner of the European Space Agency call for proposals "ID 36 GNSS-SCIENCE ANNOUNCEMENT OF OPPORTUNITY".

2012-present: Member of the board of scientists and experts of Centro Fermi

2012: **Chairman** of the Second International LARES Science Workshop, Accademia dei Lincei, Rome, September 2012.

2012: **Chairman** of the Third International LARES Science Workshop, Rome, June 2015.

2019: **Chairman** of the Fourth International LARES/First LARES 2 Science Workshop, Rome, July 2019.

2009-present: **Principal Investigator** of the ***LARES (LAser RElativity Satellite)*** satellite space experiment for the Italian Space Agency.

2017-present: **Principal Investigator** of the ***LARES 2 (LAser RElativity Satellite 2)*** satellite space experiment for the Italian Space Agency.

3. *Main* Honors, Awards, Fellowships and Mentions

1987: USA **National Research Council Fellowship** for **JPL-Caltech.**

1996: **Award** of the US "**American Association of Publishers**" as author (with John A. Wheeler) of the **best 1995 professional and scholar book in physics and astronomy** (Gravitation and Inertia, Princeton University Press).

2001: **International Tomassoni-Chisesi Award for Physics** of Sapienza, University of Rome, awarded in Rome by Nicola Cabibbo.

2006: “Chiamata per chiara fama” by “Sapienza” University of Rome.

2007: **Cover** of the 6th September 2007 issue (n. 449) of **Nature** dedicated to his research on tests of General Relativity using Earth’s artificial satellites.

2010: **International Occhialini Prize and Medal** of the British Institute of Physics (IOP) and SIF, awarded in London by the president of IOP-UK, Jocelyn Bell Burnell.

2012: **Team Award of the Italian Space Agency** for the LARES mission.

2016: **Cover** of the of the March issue (vol. 76, n. 3) of the **European Physics Journal C** dedicated to his research on tests of General Relativity using Earth’s artificial satellites and LARES.

4. Teaching Activity

1980-1981: Teaching Assistant, Physics and Mathematics Departments, Sapienza, University of Rome.

1981: Teaching Assistant of General Physics I, in the Physics Department of Montana State University, Bozeman.

1982-1984: Teaching Assistant of General Physics I, in the Physics Department of the University of Texas at Austin.

1984-1986: Lecturer (Faculty member) of General Physics I in the Physics Department of the University of Texas at Austin.

1989: Visiting Professor in the Physics Department of the University of Trento, teaching a course of Gravitational Physics.

1996-2008: Visiting Professor (Professore a contratto) at “Sapienza”, University of Rome; teaching a course of Gravitational Physics (in 2000 he also taught a doctorate course of General Relativity in the Physics Department of “Sapienza”).

1999-present: Associate Professor of General Physics (Professore associato confermato di Fisica Sperimentale FIS/01), University of Salento, Lecce; teaching courses of General Physics, Electromagnetism and Relativity.

IC has been an invited teacher at a number of international schools of physics.

5. Summary of Activities in Relativity, Space Research and Gravitational Physics

He studied, for his Ph.D., with John Archibald Wheeler, Richard Matzner, Steven Weinberg and Bryce DeWitt. Since 1984 (see, e.g., I.C., **Phys. Rev. Lett.**, **56**, 278-281 (1986) and I.C., Ph.D. dissertation (1984)), Ignazio Ciufolini has developed a new field of research on tests of General Relativity and Gravitational Physics using Satellite Laser Ranging. He has then been especially active in the field of testing General Relativity and fundamental physics with space experiments, both from the point of view of theoretical studies (see, e.g., his book with John Archibald Wheeler "**Gravitation and Inertia**", Princeton University Press (1995), in part devoted to space experiments of General Relativity, and I.C., "Dragging of Inertial Frames", **Nature Review**, **449**, 41-47 (2007)) and on the experimental ground (see, e.g., I.C. and E. Pavlis, **Nature (Letters), 431**, 958-960 (2004), I.C. et al., **Eur. Phys. J. C, 76**:120 (2016) and I.C. et al., **Eur. Phys. J. C, 79**, 872 (2019)). In particular his research has been focused on the phenomenon of frame-dragging and gravitomagnetism.

In regard to his theoretical research, among other works, he studied the problem of the measurement of the spacetime curvature, Riemann tensor, using a minimum number of test particles and a generalized geodesic deviation equation (I. C., **Phys. Rev. D**, **34**, 1014-17 (1986) and I.C. and M. Demianski, **Phys. Rev. D**, **34**, 1018-20 (1986)). He then analyzed the phenomenon of frame-dragging and gravitomagnetism in General Relativity and proposed a characterization of gravitomagnetism with spacetime invariants using the Riemann curvature tensor (I.C., **Class. and Quantum Grav. A11**, 73-81 (1994) and I.C. and J.A. Wheeler, Princeton Univ. Press (1995)). In a series of papers, he studied the effect of frame-dragging on the path of photons in connection with the phenomenon of gravitational lensing, both in the gravitational field of a rotating mass and inside a rotating body (I.C. and F. Ricci, **Class. Quantum Grav. 19**, 3863-74 (2002); I.C. and F. Ricci, **Class. Quantum Grav. 19**, 3875-81 (2002); I.C. et al., **Phys. Lett. A 308**, 101-109 (2003)). He also analyzed the phenomenon of frame-dragging on the Moon orbit determined by Lunar Laser Ranging (see, e.g., I.C., **New Astron.**, **15**, 332-337 (2010)).

In 1988 and 1989, he has been the Principal Investigator for PSN (Piano Spaziale Nazionale) and Italian Space Agency, together with NASA, of an international (Italy-USA) team for the study of the space experiment LAGEOS III, a new laser ranged satellite for accurate tests of General Relativity that he proposed and studied in 1984-89 (see, e.g., I.C., **Phys. Rev. Lett.**, **56**, 278-281 (1986) and I.C., **Int. Journ. of Phys. A, 4,** 3083-3145 (1989)).

In 1987, he has been an author of a confirmation of General Relativity, the test of the "de Sitter" effect or geodetic precession, using Lunar Laser Ranging and Very Long Baseline Interferometry (**Phys. Rev. Lett., 58**, 1062-65, (1987)).

Between 1992 and 1998 he has been a member of the first international ESA-NASA team for the study of a space experiment for accurate detection of gravitational waves using an orbiting laser interferometer. This experiment was first designed as a smaller size space interferometer around Earth, called Sagittarius and Omega, and turned then into a larger space interferometer in the solar system, called **LISA** (Laser Interferometer Space Antenna).

IC is the Principal Investigator for ASI of an advanced international center for high precision orbital determination and analysis of Earth satellites (ISTARC, International SpaceTime Analysis and Research Center).

IC has proposed the use of the GALILEO satellites for further tests of General Relativity.

IC has been author of the measurement of the frame-dragging effect using the two laser ranged satellites LAGEOS and LAGEOS II and the Earth gravity field determined by the spacecraft GRACE (method proposed in I.C., **Int. Journ. of Mod. Phys. A**, **4**, 3083-3145 (1989) p. 3102 and I.C., **Il Nuovo Cimento A**, **109**, 1709-1720 (1996)). First rough detections were published in 1996-1998 (without the use of the GRACE models, see, e.g., I.C. et al., **Science**, **279**, 2100-2103, 1998)) and more accurate measurements published in 2004-2010 using the GRACE Earth gravity models and the nodes of the LAGEOS and LAGEOS II satellites (see, e.g., I.C. and E. Pavlis, **Nature (Letters), 431**, 958-960 (2004), I.C. et al., **New Astronomy**, **11**, 527-550 (2006) and I.C. et al., chapter 17, in: *General Relativity and John Archibald Wheeler*, **367**, pages 371–434. **Springer** (2010).

His 2004 Nature paper is cited by the leading experts in relativity as the first measurement of the frame-dragging effect, also called gravitomagnetism or Lense-Thirring effect, predicted by Einstein theory of General Relativity (see, e.g., the NASA web site: https://cdn.earthdata.nasa.gov/conduit/upload/1231/NASA_SOP_2009_A_snag_in_space-time.pdf and the citations of his tests by C. Will, R. O'Connell, N. Ashby, S. Kopeikin, etc.), e.g., in: Is Einstein Still Right? Clifford M. Will and Nicolas Yunes, Oxford University Press, in print 2020. In 2008 Caldwell et al. (Smith, Erickcek, Caldwell and Kamionkowski, Phys. Rev. D 77, 024015, 2008) have been able to place limits on some possible low-energy consequences of string theory that may be related to dark energy and quintessence by using the 2004 measurement of Ciufolini performed with the LAGEOS satellites.

IC has proposed (see, e.g., I.C., **Int. Journ. of Mod. Phys. A**, **4**, 3083-3145 (1989); I.C. et al., "LARES, LAser RElativity Satellite", ASI Phase A Report (1998); I.C., "On the Orbit of the LARES Satellite", arXiv:gr-qc/0609081v1 (2006) and I.C. et al., **Space Science Reviews**, **148**, 71-104 (2009), **EPJ Plus, 126**, 72 (2011), **Space Research Today 182,** 11–25 **(**2011)) a new space experiment dedicated to a further confirmation of General Relativity, i.e., the improved, very accurate, measurement of the Earth's frame-dragging, using a new laser ranged satellite that he named **LARES** (LAser RElativity Satellite). LARES has also other basic applications to space geodesy and geodynamics. The LARES space experiment to test General Relativity was successfully launched on 13th February 2012 with the new launch vehicle VEGA of ESA built by AVIO. In 2019, using the LARES, LAGEOS and LAGEOS II satellites, IC published a measurement of frame-dragging with an unprecedented accuracy of approximately 2%: I.C. et al., **Eur. Phys. J. C, 79**, 872, 2019 (see also I.C. et al., **Eur. Phys. J. C, 76**:120, 2016).

In 2019 he obtained a test of the equivalence principle, at the foundations of General Relativity, using the LARES satellite: I.C. et al., ***Scientific Reports-Nature,*** **9,** 1-10, 2019).

IC has proposed, with a series of publications, the LARES 2 space experiment to test General Relativity. LARES 2, funded by ASI in 2017, will be launched in 2020 with the new launch vehicle VEGA C. LARES 2 will test frame-dragging with an accuracy of a few parts in one thousand and the equivalence principle using different materials at a range of about 12000 km. The LARES II

satellite is an updated version of the LAGEOS 3 experiment (which he proposed to ASI and NASA in 1984-1989 with a number of publications). For the main LARES 2 publications, see, e.g.: IC et al., A new laser-ranged satellite for General Relativity and space geodesy: I. An introduction to the LARES 2 space experiment, **Eur. Phys. J. Plus 132**: 336 (2017). IC et al., A new laser-ranged satellite for General Relativity and space geodesy: II. Monte Carlo simulations and covariance analyses of the LARES 2 experiment, **Eur. Phys. J. Plus 132**: 337 (2017). IC, Richard Matzner, Vahe Gurzadyan and Roger Penrose, A new laser-ranged satellite for General Relativity and Space Geodesy III. De Sitter effect and the LARES 2 space experiment, **Eur. Phys. J. C 77**:819 (2017). IC et al., A new laser-ranged satellite for General Relativity and Space Geodesy IV. Thermal drag and the LARES 2 space experiment, **Eur. Phys. J. Plus 133**: 333 (2018).

IC is the *Principal Investigator* of both the *LARES* (2012) and *LARES 2* (2020) space experiment.

6. Publications and Invited Talks

IC is author of about 200 papers on international refereed journals and proceedings of international meetings. *Total Google Scholar citations (November 2019): 5388, h-index 37, i10-index 78*.

IC is listed as one of the “Top Italian Scientists” on the basis of his citations (http://topitalianscientists.org/top_italian_scientists.aspx)

IC is the author and co-author of a number of books, among which: “Gravitation and Inertia”, a monograph on General Relativity and its tests, with John Archibald Wheeler (Princeton University Press, 1995), awarded by the US "American Association of Publishers" as best 1995 professional and scholar book in physics and astronomy; "2001 Relativistic Spacetime Odissey" (World Scientific, 2002); “General Relativity and John Archibald Wheeler” (Springer, 2010) and “General Relativity: The most beautiful of Theories, Applications and trends after 100 years”, Centennial Jubilee Volume, Chapter 4 (De Gruyter, 2015).

IC has been an *invited* lecturer at about 60 international meeting in USA, Germany, France, Japan, Spain, Poland, Russian Federation, China, Switzerland, Brazil, Pakistan, Uzbekistan and Italy (see list).

IC is the author of a number of popular papers and works, among which: "Theories of the Universe", with contributions by Steven Hawking, John Archibald Wheeler et al. (Princeton University Press, 1996). He has been the lecturer to a number of popular conferences.

IC has published papers and done research with some of the top world experts of General Relativity, including John Archibald Wheeler and Roger Penrose.

6a. 20 Selected Publications

Ignazio Ciufolini and J. Wheeler, "Gravitation and Inertia", ***Princeton University Press,*** (1995). *Cited (November 2019), e.g., by Scholar Google, 860 times.*

Ignazio Ciufolini and E. C. Pavlis, “A Confirmation of the General Relativistic Prediction of the Lense-Thirring Effect”, ***Nature***, ***431***, 958-960, 2004. *Cited (November 2019), e.g., by Scholar Google, 518 times.*

Ignazio Ciufolini, et al., "Measurement of the Lense-Thirring Effect with Two Laser Ranged Satellites Orbiting Earth", ***Science***, ***279***, 2100-2103 (1998). *Cited (November 2019), e.g., by Scholar Google, 268 times.*

Ignazio Ciufolini, "Measurement of the Lense-Thirring Effect on Lageos and Another High Altitude Laser Ranged Artificial Satellite", ***Physical Review Letters***, ***56***, 278-281 (1986). *Cited (November 2019), e.g., by Scholar Google, 253 times.*

Ignazio Ciufolini, “Dragging of Inertial Frames”, ***Nature***, ***449***, 41-47 (2007). *Cited (November 2019), e.g., by Scholar Google, 122 times.*

Ignazio Ciufolini, "A Comprehensive Introduction to the Lageos Gravitomagnetic Experiment, from the Importance of the Gravitomagnetic Field in Physics to a Preliminary Error Budget", ***Int. Journ. of Phys. A*****, 4**, 3083-3145 (1989). *Cited (November 2019), e.g., by Scholar Google, 116 times.*

Ignazio Ciufolini, with B. Bertotti and P. Bender, "New Test of General Relativity: Measurement of the De Sitter Effect", ***Physical Review Letters***, ***58***, 1062-65 (1987). *Cited (November 2019), e.g., by Scholar Google, 100 times.*

Ignazio Ciufolini, "Generalized geodesic deviation equation", ***Physical Review D****,* 34, 1014-17 (1986).

Ignazio Ciufolini and M. Demianski, "How to measure the curvature of space-time", ***Physical Review D***, 34, 1018-20 (1986).

Ignazio Ciufolini and F. Ricci, “Time delay due to spin and gravitational lensing”, ***Classical and Quantum Gravity,*** **19**, 3863–3874 (2002).

Ignazio Ciufolini, S Kopeikin, B Mashhoon and F Ricci, “On the Gravitomagnetic Time Delay”, ***Physics Letters A****,* 308, 101-109 (2003).

Ignazio Ciufolini, E. C. Pavlis and R. Peron, “Determination of frame-dragging using Earth gravity models from CHAMP and GRACE”, ***New Astronomy***, **11**, 527-550 (2006).

Ignazio Ciufolini, “General Relativity and Dragging of Inertial Frames”, in *“General Relativity: The most beautiful of Theories, Applications and trends after 100 years”*, *Centennial Jubilee*

Volume of General Relativity, ed. C. Rovelli 125-162 (***De Gruyter,*** January 2015). http://www.degruyter.com/view/product/247618

Ignazio Ciufolini, "One Hundred Years of General Relativity, Einstein's Gravitational Theory and Its Observational Triumph", ***Il Nuovo Saggiatore,*** **31**, n.6 (2015).

Ignazio Ciufolini, Antonio Paolozzi, Erricos C. Pavlis, Rolf Koenig, John Ries, Vahe Gurzadyan, Richard Matzner, Roger Penrose, Giampiero Sindoni, Claudio Paris, Harutyun Khachatryan and Sergey Mirzoyan "A test of general relativity using the LARES and LAGEOS satellites and a GRACE Earth gravity model. Measurement of Earth's dragging of inertial frames", ***The European Physical Journal C,*** **76**:120 (2016).

Ignazio Ciufolini, Antonio Paolozzi, Erricos C.Pavlis, Giampiero Sindoni, Rolf Koenig, John C.Ries, Richard Matzner, Vahe Gurzadyan, Roger Penrose, David Rubincam and Claudio Paris, A new laser-ranged satellite for General Relativity and space geodesy: I. An introduction to the LARES 2 space experiment, ***The European Physical Journal Plus,*** **132**: 336 (2017).

Ignazio Ciufolini, Erricos C. Pavlis, Giampiero Sindoni, John C. Ries, Antonio Paolozzi, Richard Matzner, Rolf Koenig and Claudio Paris, A new laser-ranged satellite for General Relativity and space geodesy: II. Monte Carlo simulations and covariance analyses of the LARES 2 experiment, ***The European Physical Journal Plus,*** **132**: 337 (2017).

Ignazio Ciufolini, Richard Matzner, Vahe Gurzadyan and Roger Penrose, A new laser-ranged satellite for General Relativity and Space Geodesy III. De Sitter effect and the LARES 2 space experiment, ***The European Physical Journal C*** **77**:819 (2017).

Ignazio Ciufolini, A. Paolozzi, E.C. Pavlis, G. Sindoni, J. Ries, R. Matzner, R. Koenig, C. Paris and R. Penrose, An improved test of the general relativistic effect of frame-dragging using the LARES and LAGEOS satellites. ***The European Physical Journal C*****,** ***79***, 872 (2019).

Ignazio Ciufolini, et al., "Satellite laser-ranging as a probe of fundamental physics" ***Scientific Reports-Nature,*** **9,** 1-10 (2019).

See also:

P. Bender, A. Brillet, I. Ciufolini, et al., LISA Laser Interferometer Space Antenna for the detection and observation of gravitational waves: Pre-Phase A Report, Max-Planck Institut (1998) at: http://lisa.nasa.gov/documentation.html. (see also: K. Danzmann et al., "*LISA, Laser Interferometer Space Antenna for Gravitational Waves measurements*", Class. Quantum Grav. 13, A 247 (1996)).

6b. Main invited and plenary talks at International Meetings

VII Italian Meeting on General Relativity and Gravitation, Rapallo, Italy, Settembre 1986.

VI International Workshop on Laser Ranging Instrumentation, Antibes-Juan Les Pins, France, Settembre 1986.

NASA Workshop on Relativistic Gravitation Experiments in Space, Annapolis, Maryland, Giugno 1988.

IV Italian Meeting GIFCO, Anacapri, Italy, Settembre 1988.

VIII Italian Meeting on General Relativity and Gravitation, Capri, Italy, Settembre 1990.

I William Fairbank Meeting on Relativistic Experiments in Space, Rome, Italy, Settembre, 1990.

VI International Marcel Grossmann Meeting on General Relativity, Kyoto, Japan, Giugno 1991.

XII International Moriond Workshop on Foundations and Tests of Physics and Gravitation, Les Arcs, France, Gennaio 1992.

X Italian Conference on General Relativity and Gravitation, Bardonecchia, Italy, Settembre 1992.

International Symposium on Experimental Gravitation, Nathiagali, Pakistan, Giugno - Luglio, 1993.

International Conference on Mach's principle, from Newton's Bucket to Quantum Gravity, Tubingen, Germany, Luglio 1993.

XIV Moriond Workshop on Foundations and Tests of Physics and Gravitation, Villars Sur Ollon, Svizzera, Gennaio 1994.

International Conference on Fundamental Physics Missions in Space, El Escorial (Madrid), Spain, Aprile 1994.

International Conference on Phenomenology of Unification from Present to Future, Rome, Italy, Marzo 1994.

XXI General Assembly of the International Union of Geodesy and Geophysics, Boulder, Colorado, Luglio 1995.

II International Conference on Phenomenology of Unification from Present to Future, Rome, Italy, Aprile 1997.

III William Fairbank Meeting on Relativistic Experiments in Space, Rome, Italy, Giugno 1998.

XIII Italian Conference on General Relativity and Gravitation, Bari, Italy, Settembre 1998.

II International Symposium on Experimental Gravitation, Samarkand, Uzbekistan, Agosto 1999.

International COSPAR-2000 Meeting, Warsaw, Polland.

Plenary talk at Spanish Relativity Meeting-ERES 2000, Valladolid, Spain, 2000.

Plenary talk at XXV Johns Hopkins Workshop, Florence, Settembre 2001.

XXII Physics in Collision Conference, Stanford, CA, USA, June 2002.

ICRA Conference on Black Holes, General Relativity and Gravitational Waves, Pescara, Italy, July 2002.

Plenary talk at First Villa Mondragone International School of Gravitation and Cosmology, Monte Porzio Catone, Roma, Italia, September 2002.

Plenary talk at ESA workshop on Hyper, Paris, France, November 2002.

Agava 2003, Order and chaos in stellar and planetary systems, St. Petersburg, Russia, 17-24 August 2003.

11 th Lomonosov Conference on Elementary Particle Physics, Moscow, Russia, 21-27 August 2003.

Plenary talk at X International Marcel Grossmann Meeting on General Relativity, Rio de Janeiro, Brasil, July 2003.

Plenary talk at International School of Subnuclear Physics, Erice, Italy, August-September, 2005.

Plenary talk at Convegno GRAVITAZIONE E COSMOLOGIA dell'Accademia Nazionale delle Scienze detta dei XL per il centenario della Relatività di Einstein, Roma, 5-6 maggio 2005.

Plenary talk at International School on Astrophysical Relativity "John Archibald Wheeler", Erice, Italy, 31 May-8 June 2006.

Plenary talk at From Quantum to Cosmos II (Q2C2) Workshop. June 10–13, Bremen**,** Germany, 2007.

16th International Workshop on Laser Ranging, Poznan, Poland, October 13-17, 2008

Plenary talk at From Quantum to Cosmos III, Fundamental Physics in Space for the next Decade, July 6-10, Warrenton, Virginia 2008.

Plenary talk at The Nature of Gravity Confronting Theory and Experiment in Space, Workshop at the International Space Science Institute Bern, Switzerland, 6–10 October 2008.

Plenary talk at International Astronomical Union Symposium 261, Relativity in Fundamental Astronomy, Virginia Beach, VA, USA, 27 April-1 May 2009.

Plenary talk at First International LARES Science Workshop, Rome, Italy, July 3-4, 2009.

First Lunar Laser Ranging Workshop, International Space Science Institute, Bern, Switzerland, February 16-18, 2010.

Spring Meeting of the German Physical Society, Bonn, March 15 - 19, 2010.

Third Italian-Pakistani Workshop on Relativistic Astrophysics, Lecce, Italy, 20-22 June (2011).

Third Lunar Laser Ranging Workshop in ISSI, Berne, 22-23 March, 2012.

Plenary talk at Second International LARES Science Workshop, Rome, Italy, 17-18 September 2012.

Annual Meeting of the Italian Physical Society (SIF), Naples, 17-21 September 2012.

Plenary talk at the International Workshop From Quantum to Cosmos V. Space-based research in fundamental physics and astronomy, Cologne, Germany, October 9-12, 2012.

International Conference The Time Machine Factory, Turin, Italy**,** 14-19 October 2012.

Spacepart12 International Conference at CERN, Geneve, Switzerland, 5-7 November 2012.

Plenary talk at the 5th International Symposium on Experimental Gravitation, Nanchang, Jiangxi, China, 7-13 July 2013.

Plenary talk at the 23rd Workshop on General Relativity and Gravitation, Hirosaki, Japan, 5-8 November 2013.

Invited talk at the IEEE International Workshop on Metrology for Aerospace**,** Benevento 29-30 May 2014.

Invited Talk at the Workshop on Local Effects in Gravitational Physics: Theoretical and Experimental Aspects, Salerno, 15 December 2014.

Invited Talk at the Il Workshop on "Integrability and nonlinearity in field theory", Vietri, 27-29 March 2015.

Plenary Talk at the Third International LARES Science Workshop: Fundamental Physics in Space: Celebrating One Hundred Years of General Relativity, Rome, Italy, 15-17 June 2015.

Invited Talk at the conference “Relativistic Geodesy Foundations and Applications”, Bad Honnef, Germany, 13-19 March 2016: http://puetzfeld.org/relgeo2016/relgeo2016_flyer.pdf

V Italian-Pakistani Workshop on Relativistic Astrophysics, Lecce, Italy, 21-23 July 2016 (delivered on his behalf by V. Gurzadyan).

Invited Talk at the XXII SIGRAV Conference on General Relativity and Gravitational Physics, Cefalù, Italy, 12-18 September 2016 (delivered on his behalf by C. Paris).

Plenary invited Talk at the “Fundamental Physics in Space", Bremen, Germany, October, 23-27, 2017.

Plenary invited Talk at the “International Workshop on Gravitomagnetism and Large-Scale Rotation Measurement”, GRM2018 Workshop, Wuhan Institute of Physics and Mathematics of Chinese Academy of Sciences, WIPM, China, June 6-10, 2018.

Plenary speaker at the First LARES 2, Fourth LARES and second GRM international workshop, Rome Italy, 1-5 July 2019.

Keynote invited speaker at the XXV Aerospace Meeting of AIDAA. Rome, Italy, 9-12 September 2019.