


Luciano Iess

Curriculum Vitae and Publication List

Last update: 27 January 2019 (only peer reviewed publications up to date)

General Information

Full Name	Luciano Iess	
Citizenship	Italian	
Office Phone Number	+39 06 44585336	
E-mail	luciano.iess@uniroma1.it	
Interests	Geology, canyoning, trekking	

Education

1976-1980 Alumnus, Collegio Ghislieri, Pavia, Italy
1981 *Laurea* in physics, with honors, University of Pavia, Italy

Academic and Research Appointments

1982-1992 Research scientist at Istituto di Fisica dello Spazio Interplanetario, Consiglio Nazionale delle Ricerche (CNR, Italian National Research Council), Frascati, Italy
1992-2015 Associate professor of Aerospace Engineering, Sapienza Università di Roma, Rome, Italy
1993 Visiting Research Scientist, European Space and Technology Centre (ESTEC), European Space Agency, Noordwijk, The Netherlands (4 months)
1995-1996 Visiting Scientist, California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Ca., USA (12 month, supported by a National Science Foundation grant)
1997 Visiting Scientist, California Institute of Technology, Jet Propulsion Laboratory (supported by a short term fellowship from the Italian National Research Council)
2015 Professor of Aerospace Engineering, Sapienza Università di Roma, Rome, Italy

Major Scientific and Technical Achievements

- 2003: Most accurate test of Einstein's theory of General Relativity to date (paper #4 in section "Selected Publications").

- 2005-2011: Development of the ESA ΔDOR, an essential tool for deep space navigation and European access to deep space by enabling measurements of spacecraft's angular positions at nanoradian level (see Conference Proceedings #43 and Funding Information).
- 2012: Discovery of Titan's internal ocean (ranked within the top 100 scientific discoveries of the year 2012 by Discover Magazine, paper #18 in section "Selected Publications").
- 2014: Discovery of Enceladus' internal sea (ranked within the top 100 scientific discoveries of the year 2014 by Discover Magazine, within top 25 scientific discoveries of the year by the magazine Science News and within the top 10 discoveries of the year by the Italian newspaper La Repubblica - paper #22 in section "Selected Publications").
- 2018: Measurement of the asymmetric component of Jupiter's gravity field and determination of the depth of the jet streams (papers #23-25 in section "Selected Publications").
- 2019: Measurement of Saturn's gravity field, determination of the depth of the jet streams, mass and age of the rings from Cassini radio tracking data. The first dynamical determination of the mass of Saturn's rings is an unequivocal indication that the rings formed much later than the planet (paper #26 in section "Selected Publications").

Awards

Major awards

- 2014 (Aug. 14) NASA Exceptional Public Service Medal ("For the exceptional service and scientific discoveries by means of the Cassini Radio Science Investigations and collaboration between NASA/JPL and Agenzia Spaziale Italiana.")
- 2016 (Nov. 15) Jean-Dominique Cassini Medal of the European Geosciences Union (EGU) ("The medal has been established to honour scientists who have achieved exceptional international standing in planetary and space sciences in the spirit of Jean Dominique Cassini.")

Other Individual and Group Awards

- 1990: European Space Agency Award to L. Iess "For making a valuable contribution to the Ulysses Project."
- 1992 (June 30): NASA Group Achievement Award for the Ulysses Spacecraft Development, Integration, and Launch Support Team, to Luciano Iess, Search for Gravitational Waves Team, "In recognition of outstanding conduct of Ulysses science and mission operations during the Jupiter Flyby period".
- 1993 (February 10): NASA Group Achievement Award for the Ulysses Jupiter Flyby Team, to L. Iess, Search for Gravitational Waves Team, "In recognition of outstanding developments and integration of science instruments".
- 1998 (April 14): NASA Group Achievement Award for the Cassini Program, Doppler Wind Experiment Team, to Luciano Iess "In recognition of outstanding achievements in the innovative design, build and timely delivery of the Huygens Probe Doppler Wind Experiment".

- 2009 (April 17): NASA Group Achievement Award to Luciano Iess, Cassini Radio Science Team, “For outstanding contributions leading to the success of the Cassini Radio Science Investigation at Saturn”.
- 2012 (Nov. 5): NASA Certificate of Appreciation to Luciano Iess, KaT Team, “For exceptional accomplishment in the development and delivery of the Ka-band translator for Juno mission to Jupiter”.
- 2015 (Apr. 17): European Space Agency Award to Luciano Iess “In recognition for your outstanding contribution to the Cassini-Huygens mission”.
- 2015 (June 2): NASA Group Achievement Award to Luciano Iess, Cassini Solstice Mission Titan Team, “For leadership and technical expertise in realizing the Solstice Mission Titan science objectives including the 100th Titan flyby”.
- 2015 (June 2): NASA Group Achievement Award to Luciano Iess, Enceladus and Titan Gravity Science Team, “For exceptional achievements in planning and executing gravity science experiments revealing the interior structures of Saturn’s moons Titan and Enceladus”.
- 2015 (June 2): NASA Group Achievement Award to Luciano Iess, Juno Orbital Studies Team, “For outstanding technical rigor and creativity in completing Juno’s Orbital Operations risk assessment and operation studies”.
- 2018 (July 6): International Prize “Carlo d’Angiò” for Science and Research, Celano, Italy

Appointments in Scientific and Technical Boards

1997-2003	Science Advisory Group of the Mercury Orbiter mission (now BepiColombo), European Space Agency
1998	Peer Review Committee for the selection of the payload of the mission Mars Express, ESA
1999-2003	Solar System Working Group (SSWG), European Space Agency (ESA)
2007-2008	Topical Working Groups, Italian Space Agency
2007-2010	Space Science Advisory Committee (SSAC), European Space Agency (This is the highest advisory body of ESA’s scientific programme.)
2011-2014	STE-QUEST Mission Concept Science Study Team (M-class mission; optical clocks and atom interferometry in space), European Space Agency
2011-2013	Science Advisory Group of the Mars Network Science Mission (now INSPIRE), European Space Agency
2014-2018	Human Spaceflight and Exploration Science Advisory Committee (HESAC) European Space Agency
2019	Member of ESA’s “Cosmic Vision 2050 Senior Committee” (provisional name), supervising the new long-term planning exercise for the Science Programme.

Other appointments

- Member of national boards for the confirmation of associate professors and researchers (appointment from the Italian Ministry of Education, University and Research)
- Member of PhD evaluation boards (in Italy and abroad)
- Member of boards for the selection of research assistants (Sapienza Univ. di Roma)
- Technical advisor to Selex-Galileo in the legal controversy with Compagnia Generale dello Spazio (CGS) on the PRISMA program of the Italian Space Agency

Teaching Appointments

Recent appointments in the Aerospace Engineering, Space Engineering, and Astronautical and Space Engineering curricula, Sapienza Università di Roma

2009-2010	Dipartimento di Ingegneria Aerospaziale Astronautica	Space Missions and Systems
2010-now	Dipartimento di Ingegneria Meccanica e Aerospaziale	Space Missions and Systems (*)
2010-2015	Dipartimento di Ingegneria Meccanica e Aerospaziale	Space Environment and Instrumentation
2014-now	Dipartimento di Ingegneria Meccanica e Aerospaziale	Space Environment

(*) Course shared with prof. C. Olivieri in the second semester of 2012 course (February-May 2013).

Appointments in the period 1992-2009, Aerospace Engineering and Astronautical Engineering curricula, Sapienza Università di Roma

1992-2009	Scuola di Ingegneria Aerospaziale	Aerospace Instrumentation
	Scuola di Ingegneria Aerospaziale	Space Environment and Instrumentation
	Scuola di Ingegneria Aerospaziale	Physical Sciences Experiments in Space
	Scuola di Ingegneria Aerospaziale	Space Environment

Teaching appointments in Master Courses and Schools

- Director of the Course on “Planetary Interiors”, International School of Space Science, L’Aquila, Italy, 12-16 September 2016, L’Aquila (Italy).
- Master course in Satellites and Orbiting Platforms (Sapienza Univ.), Space Environment and Science Missions module (2003-2017).
- Master course in Space Science and Technology (University of Tor Vergata), Space Missions seminars (2011-2017).
- Summer School on Planetary Geodesy & Remote Sensing, July 1-7, 2013, Shanghai, China.
- 1st Sardinian Summer School in Astrophysics, Single Dish Radio Astronomy and Radio Science (Pula, Sept. 12-17, 2011).
- 2nd Sardinian Summer School in Astrophysics, Technology in Radio Astronomy and Space Science (Pula, June 11-16, 2012).
- Master course in Space Communications Systems (Fondazione Space Academy), seminar on “Science Missions: Scenarios and Prospects” (Fucino, 2006).
- SIGRAV Graduate School in Contemporary Relativity and Gravitational Physics, VIII Edition, “Gravity: Where Do We Stand?”, Villa d’Olmo, Como, May 11-15, 2009.

As Thesis Advisor

- Advisor of 17 doctoral thesis
- Advisor of more than 40 master thesis

Miscellaneous Appointments

Reviewer and referee

- Referee for numerous journals (including *Science* and *Nature*)
- External reviewer for the selection of proposals for NASA's Cassini Data Analysis Program (CDAP, 2011)
- Reviewer for EU FP7 program "ESPACE: Exploitation of space science and exploration data in Space" (2012-2013)
- Member of the NASA board for the selection of proposals for the Cassini Data Analysis Program (CDAP, 2013)
- Reviewer for the Deutsche Forschungsgemeinschaft (DFG), Germany's major independent research funding agency (2014)
- External reviewer for NASA's NSPIRES Program, Astrobiology Institute Cycle 7 (2014)
- External reviewer for the selection of the science payload of NASA's Europa Mission (2015)
- Reviewer for the U.S.-Israel Binational Science Foundation (2015)
- Reviewer for the Agence Nationale de la Recherche (ANR, French National Research Agency) (2015)
- Reviewer for the Italian Space Agency (ASI) and the Italian National Nuclear Physics Institute (INFN)
- Member of the Scientific Committee of the PhD Funding Project, Fondazione Cassa di Risparmio di Padova e Rovigo, for the funding of the Graduate Schools of the University of Padua (2012-2014)
- Member of the Evaluation Committee of the Starting Grants Project, Science and Technology, Fondazione Cassa di Risparmio di Padova e Rovigo (grants for research projects led by young researchers of the University of Padua, 2015)
- Member of the ESA Review Panel for the evaluation of the JUICE Interdisciplinary Scientist proposals (2015).

Other miscellaneous appointments

- Member of national boards for the confirmation of associate professors and researchers (appointment from the Italian Ministry of Education, University and Research)
- Member of PhD evaluation boards (in Italy and abroad)
- Member of boards for the selection of research assistants (Univ. La Sapienza)
- Member of boards for the selection of assistant professor (Politecnico di Torino)
- Member of the board for the selection of technical staff at the Italian Space Agency
- Technical advisor to Selex-ES in the legal controversy with Compagnia Generale dello Spazio (CGS) (2013-2015)

Participation in Space Projects and Missions

As Principal Investigator or Science Team Member, in response to an open, competitive, Announcement of Opportunity

- 1990: Membership in the Radio Science Team of the mission Cassini to Saturn (individual proposal selected by NASA – AO OSSA-1-89).
- 1998: Principal Investigator in the experiment RSIS (Radio Science Investigations with SMART-1) for the ESA technology demonstration mission SMART-1 (selected by ESA, Announcement of Opportunity SCI(98)2, 1998).
- 2004: Principal Investigator of the experiment MORE (Mercury Orbiter Radioscience Experiment) of the ESA mission BepiColombo (selected by ESA, Announcement of Opportunity SCI-PB/RFP/1155, 2004)

- 2012: Principal Investigator of the 3GM (Geodesy and Geophysics of Jupiter and the Galilean Moons) of the ESA mission JUICE to the Jovian system (selected by ESA, Announcement of Opportunity ESA/SRE(2012)4)

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As Co-Investigator, in response to an open, competitive, Announcement of Opportunity

- 1983: Co-Investigator in the experiment RETE (Research on Electrodynamic Tether Effects) for the missions of the Tethered Satellite System (TSS-1 e TSS-1R) (selected by ASI and NASA).
- 1989: Co-Investigator in the experiment GWE (Gravitational Wave Experiment) of the ESA mission Ulysses (selected by ESA).
- 1990: Co-Investigator in the experiment DWE (Doppler Wind Experiment) of the mission Huygens to Titan (selected by ESA).
- 1993: member of the Joint Gravitational Wave Experiment team, for the missions Ulysses (ESA), Galileo and Mars Observer (NASA).
- 2007: ASI Principal Investigator of the instrument KATS (Ka-band Transponder System) of the NASA mission JUNO.
- 2010: member of the STE-QUEST team (proposal selected for Phase A study, M-class mission)

As Study Lead, in response to an open Invitation to Tender (ITT) or direct negotiation

- 2005: Team Lead for the development of the ESA Δ DOR Correlator for the determination of the angular position of interplanetary probes (four ESA contracts between 2005-2011)
- 2010: Lead of the study “Interdisciplinary Study on Enhancement of End-to-End Accuracy for Spacecraft Tracking Techniques”, ESA GSP Programme ITT AO/1-6221/09/F/MOS [prime contractor: DIMA; subcontractors: Thales Alenia Space Italy, British Aerospace Systems, Almaspace]
- 2014: Lead of the study “Improvement of Δ DOR performances for 1 nrad accuracy for precise landing support”, ESA ITT AO/-1-7678/13/D/EF [prime contractor: DIMA; subcontractors: Thales Alenia Space Italy, British Aerospace Systems, ArpSoft]

Funding Information

Contracts as PI-Principal Investigator or Study Lead (2005-now)

Year	Title	Funding Agency
2005	Design and Development of a SW Correlator for Deep Space Tracking Support	ESA
2006	Attività Scientifiche fase A/B1 BepiColombo MORE	ASI
2006	Enhancement of the S/W Correlator for Deep Space Tracking Support	ESA
2007	Enhancement of the S/W Translator for Deep Space Tracking Support	ESA
2009	Cassini-Huygens Fase E2 – Attività scientifiche	ASI
2009	Radio Scienza per BepiColombo e Juno fasi B2/C/D	ASI
2010	Enhancement of the Δ DOR Software	ESA

	Package	
2011	Interdisciplinary Study on Enhancement of End-to-End Accuracy for Spacecraft Tracking Techniques	ESA (GSP Programme)
2013	Studio degli strumenti scientifici per la missione JUICE – 3GM	ASI
2013	Improving Data Return in Ka-Band by Use of Weather Forecast	ESA
2015	Radio Scienza per BepiColombo e Juno fasi B2/C/D - Addendum	ASI
2015	Partecipazione italiana alla missione JUICE – Esperimento 3GM	ASI/INAF
2015	Attività scientifiche per Cassini Fase E2 Continuazione – Radio Scienza	ASI/INAF
2015	Partecipazione italiana alla missione JUICE – Esperimento 3GM	ASI/INAF
2017	Estensione attività scientifiche per Cassini fase E – Radio Scienza	ASI/INAF
2017	Partecipazione italiana alla fase A della missione VERITAS	ASI
2017	Radio scienza per BepiColombo e Juno: prosecuzione attività scientifiche	ASI

As Group Lead of a subcontractor unit (after 2007)

Year	Study/Contract	Agency	Prime contractor
2008	Radiocomm Signals: a “New Way” of Probing the Surf of Planets	ESA	GMV
2009	Radio Tracking of a Landed Spacecraft: Determination of the Spacecraft Position and the Ephemeris and Orientation in Space”	ESA	GMV
2014	HERO: High performance time and frequency link: microwave	ESA	WISER
2014	End-to-End Mission Performance Simulators for Space Science Missions	ESA	GMV
2015	Flexible and Autonomous TT&C Transponders for Multi-Mission Applications	ESA	Thales Alenia Space Italy
2015	CUBATA for Asteroid Impact Mission Cubesat Opportunity Payloads (COPINS)	ESA	GMV
2016	CDMA Implementation for TT&C and Precision Navigation	ESA	Thales Alenia Space Italy

Research Activities

Keywords

- Spacecraft tracking systems
- Orbit determination
- Space instrumentation
- Planetary geodesy
- Solar system exploration
- Solar system environments

Summary of Scientific Achievements

Peer reviewed papers	77
Conference papers	77(*)
Conference abstracts	90(*)

(*) Last update: 2015

(27 January 2019)

WoS

Scopus

	WoS	Scopus
Products	95	113
Total Citations	2744	3170
Total Citations (without self citations)	2597	2632
Average Citations per Product	28.88 (*)	28.05 (*)
Average Citations per Product (without self citations)	27.34 (*)	24.15 (*)
H-index	25	26
H-index (without self citations from author)	N/A	25

(*) Total citations / number of products

Selected publications (top 26, since 2000)

- 1) J. Corsi, L. Iess: "Stability and Control of Electrodynamic Tethers", *Acta Astronautica*, **48**, 491 (2001)
- 2) L.Iess, G.Boscagli: "Advanced radio science instrumentation for the mission BepiColombo to Mercury", *Planet. Space Sci.*, **49**, 1597 (2001)
- 3) L.Iess, C.Bruno, C.Ulivieri, G.Vannaroni, B.Bertotti, L.Anselmo, U.Ponzi, M.Dobrowolny, F. De Venuto, M.Parisse, G.Laneve: "Satellite deorbiting by means of electrodynamic tethers: general concepts and requirements", *Acta Astronautica*, **50**, 399 (2002)
- 4) B. Bertotti, L. Iess, P. Tortora: "A test of general relativity using radio links with the Cassini spacecraft" *Nature*, **425**, 374-376 (2003). doi:10.1038/nature01997 [Supporting Online Material can be downloaded from the web page of the doi link.]
- 5) J.W. Armstrong, L. Iess, P. Tortora, B. Bertotti: "Stochastic gravitational wave background: upper limits in the 10^{-6} - 10^{-3} Hz band" *Astrophys. J.*, **599**, 806-813 (2003). doi: 10.1086/379505
- 6) P. Tortora, L. Iess, J.J. Bordi, J.E. Ekelund, D.C. Roth: "Precise Cassini navigation during solar conjunctions through multifrequency plasma calibrations" *J. Guidance, Control and Dynamics*, **27**(2), 251-257 (2004). doi:10.2514/1.997
- 7) L. Somenzi, L. Iess, J. Pelaez: "Linear stability analysis of electrodynamic tethers" *J. Guidance, Control and Dynamics*, **28**(5), 843-849 (2004). doi: 10.2514/1.11822
- 8) S.W. Asmar, J.W. Armstrong, L. Iess, P. Tortora: "Spacecraft Doppler tracking: Noise budget and accuracy achievable in precision radio science observations" *Radio Science*, **40**, RS2001 (2005). doi:10.1029/2004RS003101
- 9) P. Tortora, L.Somenzi, L.Iess, R. Licata: "Small mission design for testing in-orbit an electrodynamic tether deorbiting system" *J. Spacecraft and Rockets*, **43**(4), 883-892 (2006). doi: 10.2514/1.15359
- 10) L. Iess, N.J. Rappaport, P. Tortora, J. Lunine, J.W. Armstrong, S.W. Asmar, L. Somenzi, F. Zingoni: "Gravity field and interior of Rhea from Cassini data analysis" *Icarus*, **190**, 585-593 (2007). doi: 10.1016/j.icarus.2007.03.027.
- 11) P. C. Thomas, J. W. Armstrong, S.W. Asmar, J. A. Burns, T. Denk, B. Giese, P. Helfenstein, L. Iess, T.V. Johnson, A. McEwen, L. Nicolaisen, C. Porco, N.J. Rappaport, J. Richardson, L. Somenzi, P. Tortora, E. P. Turtle, J. Veverka: "Hyperion's sponge-like appearance" *Nature*, **448**, 50-53 (2007). doi: doi:10.1038/nature05779. [Supporting Online Material can be downloaded from the web page of the doi link.]
- 12) L. Iess and S.W. Asmar: "Probing space-time in the solar system: from Cassini to BepiColombo" *Int. J. Mod. Phys.*, **16**, 2117-2126 (2007). Doi:10.1142/S0218271807011449.

- 13) B. Bertotti, N. Ashby, L. Iess: "The effect of the motion of the Sun on the light-time in interplanetary relativity experiments" *Class. Quant. Grav.*, **25** (4), 045013(11p) (2008). doi:10.1088/0264-9381/25/4/045013
- 14) R.D. Lorenz, B. Stiles, R.L. Kirk, M. Allison, P. Persi del Marmo, L. Iess, J.I. Lunine, S.J. Ostro, S. Hensley : "Titan's Rotation Reveals an Internal Ocean and Changing Zonal Winds" *Science*, **319**, 1649-1651 (2008). doi: 10.1126/science.1151639 [Supporting Online Material can be downloaded from the web page of the doi link.]
- 15) J.W. Armstrong, F. Estabrook, S. W. Asmar, L. Iess, P. Tortora: "Reducing antenna mechanical noise in precision spacecraft tracking" *Radio Sci.*, **43**, RS3010(7p) (2008). doi:10.1029/2007RS003766.
- 16) L. Iess, S.W. Asmar, P. Tortora: "MORE: an advanced tracking experiment for the exploration of Mercury with the mission BepiColombo" *Acta Astronautica*, **65**, 666-675 (2009). doi: 10.1016/j.actaastro.2009.01.049
- 17) L. Iess, N.J. Rappaport, R.A. Jacobson, P. Racioppa, D.J. Stevenson, P. Tortora, J.W. Armstrong, S.W. Asmar: "Gravity Field, Shape, and Moment of Inertia of Titan" *Science*, **327** (5971), 1367-1369 (2010). doi: [10.1126/science.1182583](https://doi.org/10.1126/science.1182583)
- 18) L. Iess, R.A. Jacobson, M. Ducci, D.J. Stevenson, J.I. Lunine, J.W. Armstrong, S.W. Asmar, P. Racioppa, N.J. Rappaport, P. Tortora: "The Tides of Titan" *Science*, **337**, 457-459, doi: 10.1126/science.1219631 (2012).
- 19) A. Genova, L. Iess, M. Marabucci: "Mercury's gravity field from the first six months of Messenger data" *Planet. Space Sci.*, **81**, 55-64 (2013). doi: 10.1016/j.pss.2013.02.006
- 20) D. Hemingway, F. Nimmo, H. Zebker, L. Iess: "A rigid and weathered ice shell on Titan" *Nature*, **500**, 550-552 (2013). doi:10.1038/nature12400
- 21) L. Iess, M. Di Benedetto, N. James, M. Mercolino, L. Simone, P. Tortora: "Astra: Interdisciplinary study on enhancement of the end-to-end accuracy for spacecraft tracking techniques" *Acta Astronautica*, **94**, 699-707 (2014). doi: 10.1016/j.actaastro.2013.06.011
- 22) L. Iess, D.J. Stevenson, M. Parisi, D. Hemingway, R.A. Jacobson, J.I. Lunine, F. Nimmo, J.W. Armstrong, S.W. Asmar, M. Ducci, P. Tortora: "The Gravity Field and Interior Structure of Enceladus" *Science*, **344**, 78-80 (2014). doi: 10.1126/science.1250551
- 23) L. Iess, W. M. Folkner, D. Durante, M. Parisi, Y. Kaspi, E. Galanti, T. Guillot et al.: "Measurement of Jupiter's asymmetric gravity field" *Nature*, **555**, 220-222 (2018) [https://doi:10.1038/nature25776](https://doi.org/10.1038/nature25776)
- 24) Y. Kaspi, E. Galanti, W. B. Hubbard, D. J. Stevenson, S. J. Bolton, L. Iess, T. Guillot, J. Bloxham, J. E. P. Connerney, H. Cao, D. Durante, W. M. Folkner, R. Helled, A. P. Ingersoll, S. M. Levin, J. I. Lunine, Y. Miguel, B. Militzer, M. Parisi, S. M. Wahl: "Jupiter's atmospheric jet streams extend thousands of kilometres deep" *Nature*, **555**, 223-226 (2018) [https://doi:10.1038/nature25793](https://doi.org/10.1038/nature25793)
- 25) T. Guillot, Y. Miguel, B. Militzer, W. B. Hubbard, Y. Kaspi, E. Galanti, H. Cao, R. Helled, S. M. Wahl, L. Iess, W. M. Folkner, D. J. Stevenson, J. I. Lunine, D. R. Reese, A.

Biekman, M. Parisi, D. Durante, J. E. P. Connerney, S. M. Levin, S. J. Bolton: "A suppression of differential rotation in Jupiter's deep interior" *Nature*, **555**, 227-230 (2018) <https://doi.org/10.1038/nature25775>

- 26) L. Iess, B. Militzer, Y. Kaspi, P. Nicholson, D. Durante, P. Racioppa, A. Anabtawi, E. Galanti, W. Hubbard, M.J. Mariani, P. Tortora, S. Wahl, M. Zannoni: "Measurement and implications of Saturn's gravity field and ring mass" *Science*, published online on 17 Jan., (2019) <https://doi.org/10.1126/science.aat2965>

FULL PUBLICATION LIST

Publications (Main Journals, Peer Reviewed)

- 1) L.Iess, M.Dobrowolny, B.Bertotti : "Plasma effects on Doppler measurement of interplanetary spacecraft", *Astron. Astrophys.* 121, 203 (1983).
- 2) B.Bertotti, L.Iess : "Doppler search for a gravitational background radiation with two spacecraft", *Gen. Rel. Grav.*, 17, 1043 (1985).
- 3) M.Dobrowolny, L.Iess : "Interplanetary plasma turbulence and the Doppler detection of a gravitational wave background", *Astron. Astrophys.*, 157, 346 (1986).
- 4) H.A.Shah, L.Iess., M.Dobrowolny : "Parallel proton heating in the solar wind by oblique Alfen waves", *Il Nuovo Cimento*, 9C, 1035 (1986).
- 5) L. Iess, B.Bertotti, P.Bonifazi, G.Comoretto: "Differential Doppler tracking of interplanetary spacecraft", *Il Nuovo Cimento*, 10C, 235 (1987)
- 6) L.Iess and M.Dobrowolny : "The interaction of a hollow cathode with the ionosphere", *Phys. Fluids B*, 1880, 1 (1989).
- 7) G. Vannaroni, C.B. Cosmovici, U. Guidoni, L. Iess, L. Scandurra: "Interaction of a hollow-cathode source with an ionospheric plasma", *Adv. Space Res.*, (7)147, 10 (1990).
- 8) G.Comoretto, L.Iess, B.Bertotti, G.Grueff, J.P.Brenkle, T.Horton: "Spacecraft Doppler tracking with a VLBI antenna", *Il Nuovo Cimento C*, 169, 13C (1990).
- 9) I.Ciufolini, M.Dobrowolny, L.Iess: "Effect of particle drag on the LAGEOS node and measurement of the gravitomagnetic field", *Il Nuovo Cimento B*, 573, 105B (1990).
- 10) B.Bertotti, L.Iess: "The rotation of LAGEOS", *J. Geophys. Res.*, 96, B2, 2431 (1991).
- 11) B.Bertotti, R. Ambrosini, S.W. Asmar, J.P. Brenkle, G. Comoretto, G. Giampieri, L. Iess, A. Messeri, H.D. Wahlquist: "The Gravitational Wave Experiment", *Astron. Astrophys. Suppl. Ser.*, 92, 431 (1992).

- 12) G.Comoretto, B.Bertotti, L.Iess, R.Ambrosini: "Doppler experiments with CASSINI radio system" *Il Nuovo Cimento* 15C, 1193 (1992).
- 13) B.Bertotti, G.Comoretto, L.Iess: "Doppler tracking of spacecraft with multifrequency links", *Astron. Astrophys.*, 269, 608 (1993).
- 14) M.Dobrowolny, E.Melchioni, U.Guidoni, L.Iess, M.Maggi, R.Orfei, Y.De Conchy, C. Harvey, R. Manning, F. Wouters, J.P. Lebreton, S. Ekholm, A. Butler: "The RETE experiment for the TSS-1 mission", *Il Nuovo Cimento* 17C (1994).
- 15) B.Bertotti, R. Ambrosini, J.W. Armstrong, S.W. Asmar, J.P.Brenkle, G. Comoretto, G. Giampieri, L. Iess, A. Messeri, A. Vecchio, H.D. Wahlquist : "Search for gravitational wave trains with the spacecraft ULYSSES", *Astron. Astrophys.* 296, 13-25 (1995).
- 16) G. Haerendel, A. Piras, C. Arduini, G. Catastini, F. Ellmers, D. Hall, A. Spallicci, A. Nobili, E. Graf, L. Iess, M. Perino, I. Pinto, M. Matteoni, J. Stocker: "Microsatellites and Space Station for Science and Technology Utilisation", *Acta Astronautica*, 39, p. 605 (1996).
- 17) L. Iess, C. Harvey, G. Vannaroni, J.P. Lebreton, M. Dobrowolny, R. Manning, P. Cerulli-Irelli, A. Onelli, F. De Venuto: "Plasma Waves in the Sheath of the TSS-1R satellite", *Geophys. Res. Lett.* 25, 4, 17 (1998).
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- 84) L. Imperi, M. Jr Mariani, L. Iess: “BepiColombo’s geodesy and relativity experiments from an extended mission” Geophysical Research Abstracts, Vol. 17, EGU2015-13332-1, EGU General Assembly, Wien, 12-17 Apr. 2015.
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- 87) D. Durante, L. Iess: “The detection of Jupiter normal modes with gravity measurements of the mission Juno”, EPSC Abstracts, Vol. 10, EPSC2015-476, European Planetary Science Congress (2015).
- 88) M. Parisi, L. Iess, S. Finocchiaro, E. Galanti, Y. Kaspi: “The possibility of inferring the depth of Jupiter's Great Red Spot with the Juno gravity experiment”, 2015 AGU Fall Meeting, Poster P41B-2069, Session P41B “Jove You Inside Out: Giant Planet Interiors, Atmospheres, Aurorae, and Ionospheres II Posters”, San Francisco, 13-18 Dec. 2015.
- 89) S.W. Asmar, R. Park, J.W. Armstrong, D. Buccino, W. Folkner, L. Iess, A. Konopliv, J. Lazio: “Enabling Planetary Geodesy With the Deep Space Network”, 2015 AGU Fall Meeting, P34A-01, Session P41B “Planetary Geodesy I” San Francisco, 13-18 Dec. 2015 [Invited].
- 90) L. Iess: “The interior of Enceladus from gravity and topography”, 2015 AGU Fall Meeting, Abstract P21B-07, Session P21B “Evolutions, Interactions, and Origins of Outer Planet Satellites I”, San Francisco, 13-18 Dec. 2015 [invited].

Other publications

- 1) L. Iess: voce "Sonda spaziale" della "Piccola Treccani", Istituto dell' Enciclopedia Italiana (1996).
- 2) Bird, M.K., M. Heyl, M. Allison, S.W. Asmar, D.H. Atkinson, P. Edenhofer, D. Plettemeier, R. Wohlmuth, L. Iess and G.L. Tyler: "The Huygens Doppler Wind Experiment", ESA SP-1177, 139 162, ESTEC, Noordwijk, Netherlands (1997).
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Mission or Experiment Proposals (in response to ESA, NASA and ASI AO) – Reports (Phase A and Contracts)

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- 1) "LAGEOS 3 Scientific Feasibility Study", ASI-NASA Joint Study, PI dott. I.Ciufolini (1989).
- 2) "Microsatellite Science Utilisation and Space Station" European Space Agency Contract Report by Alenia Spazio, OHB-Systems and Consultacy Team, Alenia Spazio Internal Report SD-RP-AI-0168 (1995). [accepted]
- 3) "Un satellite a filo per propulsione elettrodinamica", L.Iess e G.Vannaroni (coordinatori), in risposta al bando ASI "Idee per missioni scientifiche su piccoli satelliti" (1997).
- 4) "Coronal Science, Relativistic Gravity, X/Ka-Band Radio Technology Validation on Deep Space One", J.W.Armstrong (PI), J.D.Anderson, S.Asmar, B.Bertotti, F.B.Estabrook, S.Habbal, L.Iess, R.Woo, in risposta all' Announcement of Opportunity della NASA AO97-OSS-01 "Science Team Members for the NM DS1 Mission" (1997).
- 5) "LARES - Laser Relativity Satellite for the study of the Earth gravitational field and general relativity measurements", I.Ciufolini (PI), Phase A Study Report, ASI AO on "Idee per missioni scientifiche su piccoli satelliti" (1998).

- 6) "Mercury Cornerstone - Interim Report", G.D.Racca, R.Grard, A.Balogh, J.Brueckner, L.Iess, Y.Langevin, A.Milani, N.Thomas et al., ESA Internal Memorandum ESA/PF/1462.97/GR, Aug. 1997.
- 7) "Validation of the technologies needed for deorbiting systems based on electrodynamic tethers (DSET)", G.Vannaroni (PI), L.Iess et al., in response to the ASI AO "Proposte di utilizzazione tecnologica della stazione spaziale" (1998).
- 8) "OMEGA - A proposal to the National Aeronautics and Space Administration - Office of Space Sciences - for MIDEX", R.W.Hellings (PI), in response to the Announcement of Opportunity NASA AO98-OSS-03 (1998).
- 9) Proposal DS-TIM-PO-0001 "Novel Tracking Techniques For Esa's Future Deep Space Missions" in response to ESA ITT No: AO/1-4341/03/D/SW ESA/IPC(2003)11, Technical Coordinator Wolfgang Schäfer, TimeTech GmbH, Stuttgart.
- 10) DonQuijote: "Phase A of a Near Earth Object (NEO) Mission: Don Quijote" ESA ITT AO 1-4956/05/F/VS (2005) [Prime Contractor: AlcatelAlenia Space][selected]
- 11) "MOONTWIN – A network of landers for lunar exploration" in response to ESA Call for Ideas for NEXT Exploration Mission, PI P. Lognonnè, Scientific /technology area: Planetary Geophysics, Radio-Astronomy/EDLS, RDV, Long Life Planetary package.
- 12) Synchro: "Novel Time Synchronisation Techniques for Deep Space Probes", ESA ITT AO/1-5209/07/NL/HE [Prime Contractor: Space Engineering; 2007][selected]

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- 2) B.Bertotti, L. Iess : "Correlation between two spacecraft in the Doppler detection of a gravitational background radiation", internal report IFSI-83-7 (1983).
- 3) M. Dobrowolny, L. Iess : "Interplanetary plasma turbulence and the Doppler detection of a gravitational background radiation" internal report IFSI-85-1 (1985).
- 4) H.A. Shah, L. Iess, M. Dobrowolny : "A model for proton heating in the solar wind", IFSI-85-9 (1985).
- 5) R. Agresti, L. Iess, P. Bonifazi : "Media calibrations of the Doppler signal for a gravitational wave experiment", IFSI-86-13 (1986).
- 6) R. Agresti, P. Bonifazi, L. Iess, G.B. Trager : "Generation and reduction of the data for the Ulysses gravitational wave experiment", IFSI-87-20 (1987).

- 7) G. Vannaroni, C.B. Cosmovici, U. Guidoni, L. Iess, L. Scandurra: "Interaction of a hollow cathode source with an ionospheric plasma", IFSI-88-10 (1988).
- 8) M. Dobrowolny, L. Iess: "RETE telemetry layout", IFSI-90-8 (1990).
- 9) B. Bertotti, L. Iess: "The rotation of LAGEOS", IFSI-90-10 (1990).
- 10) A. Messeri, L. Iess: "Archival tracking data file (ATDF) and REGRES file: decoding and data reduction", IFSI-90-30 (1990).
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- 12) G. Comoretto, L. Iess, R. Cerulli-Irelli: "A Digital Tone Extractor for the Huygens-Cassini Doppler wind experiment", Technical Report 15/1990, Osservatorio Astrofisico di Arcetri (1990).
- 13) B. Bertotti, R. Ambrosini, S.W. Asmar, J.P. Brenkle, G. Comoretto, G. Giampieri, L. Iess, A. Messeri, A. Vecchio, H.D. Wahlquist: "ULYSSES' Gravitational Wave Experiment: report on the first opposition", IFSI-91-25 (1991).
- 14) R. Ambrosini, G. Comoretto, G. Giampieri, L. Iess, A. Messeri, G. Maccaferri, A. Vecchio: "Manuale d'uso per l'inseguimento Doppler di sonde interplanetarie con la parabola VLBI di Medicina", IRA-156-92 (1992).
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- 16) "Mercury Cornerstone - Interim Report", G.D. Racca, R. Grard, A. Balogh, J. Brueckner, L. Iess, Y. Langevin, A. Milani, N. Thomas et al, ESA Internal Memorandum ESA/PF/1462.97/GR, (1997).
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- 18) L. Iess, D.C. Roth: "New DSS25 station coordinates estimated from Cassini GWE1 data", IOM 312.B/04-03, 17/3/2003 (2003).
- 19) A. Ardito, L. Iess, L. Somenzi, P. Tortora: "The Effects Of Titan's Atmosphere On The Estimation Of The Quadrupole Field In T22", DIAA internal note, 3 Nov. 2006.
- 20) N. Rappaport, M. di Benedetto, L. Iess, P. Racioppa, and J. Wahr: "RSS Determination of Titan Love's Number", JPL Interoffice Memorandum IOM-343-07001, 23 Feb. 2007.

Invited Talks and Seminars

- 1) L.Iess : "Precision Doppler navigation techniques for the detection of gravitational waves in space", Course on "Spacecraft Flight Control System", Istituto CNUCE-CNR , Pisa, 10-12 Dec. 1985.
- 2) L.Iess : "Esperimenti di onde gravitazionali con sonde spaziali", Meeting on "Onde gravitazionali da collassi stellari: previsioni teoriche ed esperimenti italiani", INFN - Laboratori Nazionali di Legnaro, 20-21 May 1991.
- 3) L.Iess: "The ULYSSES gravitational wave experiment", X Convegno della Societa' Italiana di Relativita' e Fisica della Gravitazione, Bardonecchia, Sett. 1992
- 4) L.Iess: "Search for quasi-periodic gravitational waves from coalescing binaries with the spacecraft ULYSSES", First Edoardo Amaldi Conference on Gravitational Wave Experiments, Frascati, 14-17 June 1994.
- 5) L. Iess: "The Cassini Solar Conjunction Experiment", Jet Propulsion Laboratory, Dec. 5, 1995 (seminar).
- 6) L.Iess: "Spacecraft Doppler Tracking", First VIRGO Conference on Gravitational Waves, Cascina (Pisa), Italy, 19-23 Mar. 1996.
- 7) L.Iess: "Doppler Measurements of The Solar Gravitational Deflection", Cassini-Huygens International Meeting, Bologna, 19-21 Nov. 1996.
- 8) L.Iess: "Gravitational Waves and Doppler Experiments in the Cassini Mission", workshop "Review of Fundamental Physics Activities in ESA and in ASI", Roma, 14-15 May 1997.
- 9) L.Iess: "Fundamental Physics on Planetary and Astrometric Missions", Workshop "Fundamental Physics in Space", ASI-ESA, Roma, 19 Feb. 1999.
- 10) L.Iess: "Space Tethers", 7th Spacecraft Charging Technology Conference, Noordwijk, The Netherlands, 21-26 Apr. 2001 (in "A course on spacecraft charging").
- 11) L.Iess: "Radio science instrumentation for the mission BepiColombo to Mercury", General Assembly of the European Geophysical Society, Nice, May 2001.
- 12) L.Iess: "The Cassini Solar Conjunction Experiment: A Test of General Relativity Using Precision Doppler Tracking of an Interplanetary Spacecraft", XXII Texas Symposium on Relativistic Astrophysics, Stanford (USA), December 13-17, 2004.
- 13) L.Iess: "Testing General Relativity with interplanetary spacecraft tracking" INFN, Florence, Dec. 5, 2005 (seminar).
- 14) L.Iess: "Testing General Relativity with Interplanetary Spacecraft", International Workshop "Advances In Precision Tests And Experimental Gravitation In Space", Galileo Galilei Institute, Arcetri, Firenze (Italy), September 28-30, 2006
- 15) L.Iess: "Testing gravity theories with interplanetary spacecraft", Second International Workshop Q2C "From Quantum to Cosmos: Space-based Research on Fundamental Physics and Quantum Technologies", Bremen, 10-13 June 2007.

- 16) L.Iess: "The Cassini Superior Conjunction Experiment", First European Workshop On Solar System Dynamics and Ephemerides, ESOC, Darmstadt, 21-22 June 2007
- 17) L.Iess: "The gravity fields of the solar system satellites", ISSI/Europlanet workshop on "Exchange processes in icy moons", Bern, Nov. 17-21, 2008.
- 18) L. Iess: "Probing gravity by means of deep space probes" Institut für Experimentalphysik, Heinrich-Heine-Universität Düsseldorf, 26 June 2008 (seminar).
- 19) L.Iess: "Tests of Relativity in Radio Band", IAU Symposium 261 "Relativity in Fundamental Astronomy, Dynamics, Reference Frames, and Data Analysis", Virginia Beach (USA), April 29, 2009.
- 20) L. Iess: "Gravity tests in the solar system", VIII SIGRAV School ("Gravity: Where Do We Stand?"), Centro A. Volta, Villa d'Olmo, Como, 11-15 May 2009.
- 21) L. Iess: "The rotation of Titan", Celmec V, Fifth International Meeting on Celestial Mechanics, S. Martino al Cimino, Italy, 6-12 Sept. 2009
- 22) L. Iess: "Deep-space navigation as a tool to probe the laws of gravity" XIX Convegno SIGRAV, Pisa, Scuola Normale Superiore, Sept. 27- Oct. 1, 2010.
- 23) L. Iess: "Deep-space navigation: a tool to investigate the laws of gravity", seminar at Institute de Hautes Etudes Scientifiques, Bur-sur-Yvette, 13 Jan. 2011.
- 24) L. Iess: "The Gravity Fields of the Saturnian Satellites", 2011 AGU Fall Meeting (Session P44B Planetary Geodesy II", San Francisco, 8 Dec. 2011).
- 25) L. Iess: "The tides of Titan", 2012 AGU Fall Meeting (Session P23F "Titan: A Dynamic World", San Francisco, 4 Dec. 2012).
- 26) L.Iess: "The Geysers, Lakes and Oceans of the Saturnian Moons", Dip. di Fisica and INFN, Florence, Jan. 22, 2013 (seminar).
- 27) L. Iess: "Oceans, Geysers, Water Diapirs: A Peek through the Surface of the Saturnian Moons from Gravity Measurements of the Spacecraft Cassini", ESTEC, Noordwijk, The Netherlands, May 24, 2013 (seminar).
- 28) L. Iess: "A Course on Deep Space Navigation Systems and Radio Science", Beijing Institute of Tracking and Telecommunications Technology, Beijing, China, Jan. 29-31, 2013:
 1. Deep Space Navigation Systems: Where do we stand?
 2. The European Delta-DOR correlator
 3. The mission Bepicolombo
 4. The scientific use of Deep Space Tracking Systems
 5. Radio science in deep space missions
- 29) L. Iess: "Gravity Field and Tides of Titan", International Symposium on Planetary Sciences (IAPS2013), July 1-7, 2013, Shanghai, China.

- 30) L. Iess, S. Finocchiaro, P. Racioppa: “The determination of Jupiter and Saturn gravity fields from radio tracking of the Juno and Cassini spacecraft”, paper P11B-01, Shape, Internal Structure, Gravity, and Winds of Jupiter and Saturn I, 2013 AGU Fall Meeting, S. Francisco, 9-13 Dec. 2013.
- 31) L. Iess: “Trends and Goals in Deep Space Navigation Systems”, Beijing Research Institute of Telemetry, June 11, 2014 (seminar).
- 32) L. Iess: “Trends and Opportunities in Radio Science: The Scientific Use of Deep Space Tracking Systems”, Beijing Research Institute of Telemetry, June 12, 2014 (seminar).
- 33) L. Iess, S.W. Asmar, A. Anabtawi: “The Geodesy of the Outer Solar System Bodies from Precise Spacecraft Tracking”, abstract P31A-3969, 2014 AGU Fall Meeting, S. Francisco, 14-19 Dec. 2014.
- 34) L. Iess: “The interior structure of Enceladus from Cassini gravity measurements”, 2015 EGU General Assembly (Union Session 4 “What is Inside? Planetary Interiors as Viewed From Space” Vienna, 17 Apr. 2015).
- 35) L. Iess: “Clocks in Space: Uses and Limitations”, ISSI/HISPAC Workshop on High Performance Clocks, Bern, 30 Nov. – 4 Dec. 2015
- 36) L. Iess: “The interior of Enceladus from gravity and topography”, 2015 AGU Fall Meeting, Abstract P21B-07, Session P21B “Evolutions, Interactions, and Origins of Outer Planet Satellites I”, San Francisco, 13-18 Dec. 2015
- 37) L. Iess: “Probing Laws of Gravity in the Solar System: from Cassini to BepiColombo”, seminar at the University of Zurich, Institute for Computational Science, 24 Nov. 2016.
- 38) L. Iess: “The attraction of gravity”, Cassini Medal Lecture, 2017 EGU General Assembly, Vienna, 25 Apr. 2017.
- 39) L. Iess et al. (8 coauthors): “The dark side of Saturn’s gravity”, 2017 AGU Fall Meeting, Abstract U22A-03, Session U22A: Cassini's Grand Finale: Discoveries and Science Highlights”, New Orleans (USA), 12 Dec. 2017.
- 40) L. Iess: “Probing laws of gravity in the solar system”, seminar at University of California at Santa Cruz (UCSC), 25 Aug. 2017.
- 41) L. Iess: “Gossips from the gas giants”, seminar at Observatoire del la Cote d’Azur, Nice (F), 4 Oct. 2017.
- 42) L. Iess: “Gossips from the gas giants”, seminar at University of Tor Vergata, Rome, Italy, 10 Jan. 2018.
- 43) L. Iess and Y. Kaspi: “The 3GM radio science experiment onboard the ESA JUICE mission”, The 13th Ilan Ramon International Space Conference, Tel Aviv 29-30 January 2018.

