

Curriculum Vitae of Alberto Cellino

Alberto Cellino

Born in Torino, January 11, 1958

Degree in Physics, March 1982

Technician at the Astronomical Observatory of Torino (1981–1990)

Astronomer at the Astronomical Observatory of Torino (1990–2009)

“Primo ricercatore” at INAF, Astrophysical Observatory of Torino since 2009

Duties for the Italian Istituto Nazionale di Astrofisica (INAF):

- Member of the Time Allocation Committee of the Telescopio Nazionale Galileo (2004–2005).
- Member of the “Comitato di Macro Area 3” (Sun and Solar System) of the INAF (2006-2010).
- Member of the *Consiglio di Supporto alla Direzione* at the Astronomical Observatory of Torino (2010-2011).
- Member of the INAF Commission for the evaluation of the *Euclid*, *Plato* and *Solar Orbiter* space missions (2011).
- Elected Member of the new “Comitato di Macro Area 3” (Sun and Solar System) of the INAF (2011-2015).
- Member of the INAF Commission for the evaluation of the proposals of research submitted to answer the call for the PRIN INAF 2012 funding program (2013).
- Local coordinator for the preparation of the documents to be submitted by the Torino Astrophysical Observatory to INAF in the framework of the procedures for the evaluation of the Quality of the Research (VQR) of INAF (2015-2016).
- PI and national coordinator for the research project *Vesta as benchmark to understand Solar System history* funded by INAF in the framework of the 2011 PRIN research projects.

IAU duties:

- Member of Minor Planet Working Group of IAU Commission 15 (1997-2000).
- Chairman of Asteroid Working Group of IAU Commission 15 (2000-2006).
- Chairman of the Commission 15 Working Group on Asteroid Polarimetric Albedo Calibration (2006-2012).
- Member of the Commission 15 Working Group on Asteroid Magnitudes (2006-2012).
- Vice-President of IAU Commission 15 (2006/2009).
- President of IAU Commission 15 (2009/2012).
- Member of the Steering Committee of IAU Division F (2012-2015).

Coordination of research programs

- Over the years, Principal Investigator of several approved requests of observation time at observing facilities, including the Italian TNG and the ESO VLT telescopes.
- Principal Investigator of the project for the Spaceguard 1 space mission, submitted to ESA in the framework of the F2/F3 program (2000).
- Principal Investigator of the study *Remote Observations of Near-Earth Objects from Space*, under contract from Alenia Spazio funded by ESA.
- Core member of the *Gaia Solar System Working Group*, and person in charge of the simulation studies for the determination of the spin properties of asteroids based on sparse photometric data (2003-2006).
- Since 2006, Scientist in charge of the development of the software for the determination of the physical properties of Solar System objects based on data of the Gaia space mission of the ESA, and member of the Steering Committee of the Coordination Unit 4 of the Data Processing and Analysis Committee (DPAC) of the Gaia space mission.

- Coordinator of an International Team funded by the International Space Science Institute (ISSI) in Bern, for the research program *Light Scattering Phenomena in Small Body Surfaces* (2007-2008).
- Scientist in charge of the design and construction of a new polarimeter, funded by the PRIN-INAF 2009 research programs. This Torino polarimeter has been installed at a 1-m telescope in the observing station of Calern (France) in the framework of an international collaboration between INAF and the Observatoire de la Côte d'Azur (France) in the field of polarimetric investigations of solar system objects (2010-2011).
- National Coordinator of the research project *Vesta as benchmark to understand Solar System history*, funded by INAF in the framework of the 2011 PRIN-INAF program (2011).
- Since 2010, member of the international Consortium for the development of the JEM-EUSO mission, as person in charge for the events of detection of meteors and nuclearites (the latter being possible components of the dark matter). using a telescope aboard the International Space Station (ISS).
- since 2019, development of numerical simulators for the interpretation of events of detection of meteors and nuclearites from the Russian satellite Lomonosov, and from the mini-Euso telescope, a precursor of the bigger JEM-Euso project, currently active (2020) aboard the ISS.
- since 2020, development of numerical simulators for the interpretation of events of detection of meteors and nuclearites seen from the mini-Euso telescope currently operating (2020) aboard the ISS.

Other duties and tasks:

- Member of the *Observing Programs Committee* (Panel C) of the ESO (2007).
- Leader of the ISSI International Team *Light Scattering Phenomena in Small Body Surfaces* (funded by the ISSI, Bern, 2008).
- Member of the Permanent Monitoring Panel on hazardous Cosmic Objects at the Ettore Majorana Center and Foundation for Scientific Culture, Erice, Italy (2000-2015).

- Chairman of the Permanent Monitoring Panel on hazardous Cosmic Objects at the Ettore Majorana Center and Foundation for Scientific Culture, Erice, Italy (since 2016).
- Member of the Scientific Committee of the Osservatorio Astronomico della Valle d'Aosta, (2011-2016).
- Invited researcher at the *Institut de Mécanique Céleste et Calcul des Ephémérides* of the Paris Observatory (on month in 2003 and 2006, two months in 2008).
- Referee for the Academy of Sciences of the Czech Republic for the evaluation of submitted research projects (2016-2017).
- Over the years, member of the Scientific Organizing Committees of several international meetings and workshops.

Research activity:

- Between 1981 and 1984, photometry of variable stars
- Since 1984, research work in the field of Minor Bodies of the Solar System, particularly for what concerns the physical properties of asteroids. In this field, the main contributions have been on the following topics:
 - Derivation of shape and spin axis direction of asteroids from available photometric data; model of the asteroids Vesta and Gaspra; analysis of the role played by shape irregularities in the photometric lightcurves. Development of numerical simulations of particular eight-octants shapes, commonly named Cellinoid shapes, as convenient tools to simulate asteroid lightcurves.
 - Development of a semi-empirical method of the outcomes of catastrophic break-up processes among asteroids. Application to the analysis of laboratory experiments, and to asteroid dynamical families.
 - Study of the collisional evolution of the asteroid population, with emphasis on the evolution of the size and spin rate distributions.
 - Development of a statistical method for the identification of asteroid dynamical families in the main belt.

- Analysis of the physical properties of asteroid families, particularly for what concerns size distributions, reconstruction of the original ejection velocity fields of the fragments, and size-velocity relationships.
- Characterization of the surface properties of different dynamical families by means of spectroscopic observations.
- Analysis of the size distribution of the asteroid population in the main belt, and assessment of the total inventory of the population down to small sizes.
- Study of some mechanisms of injection of collisional outcomes of inter-asteroid collisions into chaotic dynamical regions; origin of near-Earth objects and meteorites.
- High-resolution observations of asteroids using Speckle Interferometry, Adaptive Optics and VLTI techniques, for the direct determination of asteroid sizes and shapes (and to discover possible binary systems).
- Application of Polarimetry to the study of the small bodies, and independent albedo estimates for asteroids observed by the IRAS satellite. Discovery of a new class of objects exhibiting peculiar polarimetric properties (“Barbarians” after their prototype, asteroid (234) Barbara). Determination of the first example of “ground truth” in asteroid polarimetry, through analysis of data taken by the Dawn space mission. Study of the polarimetric behaviour of the first interstellar comet, 2I/Borisov.
- First applications of the technique of spectro-polarimetry as a useful tool for the determination of the main surface properties of small atmosphereless bodies of our Solar system.
- Study of the data obtained by the Dawn space mission for the asteroid (4) Vesta, in order to determine the “ground truth” for the interpretation of polarimetric data obtained by means of remote observations.
- Study of the phase - magnitude curves of asteroids, and development of a new photometric system for asteroids, later officially adopted by the IAU.

- Development of software needed to perform data reduction of the asteroid observations obtained by the GAIA space mission of the European Space Agency.
- Development of software to perform numerical simulations of the signals from meteor events for feasibility studies in the framework of the JEM-Euso and Mini-Euso space mission projects.
- Study of the population of Mars Trojan asteroids, and exploitation of their determined physical properties to put new constraints for the models of the early evolution of the inner Solar System-

The results of the research activity have been published in more than 440 articles, including 212 peer-reviewed articles on the most important scientific journals for Planetary Sciences and in specialized books (Asteroids II, Asteroids III, etc.) The h-index is 41. (The above numbers refer to April, 2021. Source: ADS).

Space Activities:

- Development of concepts of space missions for the discovery and physical characterization of near-Earth objects.
- Development of software for the data reduction and interpretation for the Gaia space mission. In particular, development of a genetic algorithm for the inversion of sparse photometric data.
- Simulations of observations of meteors and nuclearites using detectors aboard the ISS in the framework of the JEM-EUSO and MINI-EUSO projects. Activities carried out with support from the Italian *Istituto Italiano di Fisica Nucleare* (INFN).
- Study of meteor observations by the TUS detector aboard the Russian satellite Mikhail Lomonosov.
- Study of meteor observations by the Mini-Euso detector aboard the International Space Station.

Education Activities:

- Teacher (4 hours) at the Master course “*Mathematical and Physical Methods for Space Sciences*”, Academic year 2019-2020, University of Torino, (2019).
- Course of Planetary Sciences (48 hours) for the *Laurea Magistrale* in Physics at the University of Torino, Italy (2003 - 2007)
- Invited teacher at the University of Sophia-Antipolis (France) for one month (2001 and 2005).
- Lectures of Physics of Asteroids for the Italian National School of Astrophysics for post-doc students in 1996 and 2001.
- Co-Director of the 6th Course of the International School of Space Chemistry (Erice, Italy, 2001).
- Co-Tutor of the three-year degree thesis *Osservazioni di nucleariti con Mini-EUSO*, student Riccardo Corno (2019).
- Co-Tutor of the three-years degree thesis *La Polarimetria per lo Studio di Asteroidi: Database di Calern*, student Andrea Veneziani (2020).
- *Rapporteur* for the appointment of the title of *Habilitation à diriger des recherches* (HDR). Candidate Benoit Carry, Université de Nice - Sophia Antipolis (2018).
- *Rapporteur* for the appointment of the title of *Habilitation à diriger des recherches* (HDR). Candidate François Colas, Observatory of Paris (2016).
- *Rapporteur* for the appointment of the title of *Habilitation à diriger des recherches* (HDR). Candidate Paolo Tanga, Université de Nice - Sophia Antipolis (2014).
- *Rapporteur* for the PHD thesis of Florian Gourgeot (University of Paris) on *Étude Comparatif des Propriétés Physico-chimiques d’Astéroïdes, de Satellites Glacés et d’Objets Transneptuniens* (2013).
- Co-Tutor for the PHD thesis of Carlo Comito on *Numerical N-body approach to binary asteroid formation and evolution* (2012).

- *Rapporteur* for the appointment of the title of *Habilitation à diriger des recherches* (HDR). Candidate Sonia Fornasier, Observatory of Paris (2012).
- Co-Tutor of the thesis *Simulation of Meteors for the JEM-EUSO experiment*, student Fabrizio Gola, *Università degli Studi di Torino* (2011).
- *Rapporteur* for the PHD thesis of Alin Nedelcu (University of Paris), on *Modélisation dynamique et spectroscopique des Astéroïdes* (2010).
- *Rapporteur* for the PHD thesis of Céline Blitz (University of Paris), on *Modélisation de la propagation des ondes sismiques et des ejecta dans les astéroïdes: Application à l'érosion des cratères de l'astéroïde (433) Eros* (2009).
- Co-reporter of the thesis *Misure di asteroidi con tecniche di alta risoluzione*, student Manuela Lippi, *Università degli Studi di Pisa* (2006).
- *Rapporteur* for the appointment of the title of *Habilitation à diriger des recherches* (HDR) for Mirel Birlean, Observatory of Paris (2005).
- *Rapporteur* for the PHD thesis of Aurélie Lebras (University of Paris), on *Étude de l'état de Surface des Astéroïdes par spectroscopie Infrarouge en Réflectance* (2001).
- Opponent for the PHD thesis of Jukka Piironen (University of Helsinki), on *Photometry of Asteroids at Small Phase Angles with Related Laboratory Measurements* (1998).
- Member of the Jury for the PHD thesis dissertation of Adriano Campo Bagatin (1997, University of Valencia, Spain).
- Tutor of the degree thesis *Gli asteroidi Aten-Apollo-Amor: Origine, evoluzione, popolazione attuale e rischi per la Terra*, student Anna Maria Simonelli, *Università degli Studi di Torino* (1996).
- *Rapporteur* for the PHD thesis of Daniel Hestroffer (University of Paris), on *Astrométrie et Photométrie des Astéroïdes Observés par HIPPARCOS. Apport à l'Élaboration d'un Système de Référence Dynamique* (1994)

- Invited Teacher at several International Schools (France, Austria, Italy)

Editorial Activities:

- Referee for the major journals specialized in Solar System studies.
- Co-Editor of the "Asteroids, Comets, Meteors 1993" book, published by Kluwer in 1994.
- Associated Editor of a special issue of the Planetary and Space Science journal devoted to proceedings of the 1999 IMPACT Workshop in Torino, Italy (2000)
- Co-Editor of the Asteroids III book, published by the University of Arizona Press (2002)
- Associated Editor of a special issue of *Advances in Space Research* (Vol.33, n.9, 2004), devoted to the proceedings of Session *NEO Impact Hazards on Earth and Other Solar System Bodies*, at the COSPAR meeting in Houston (2002).
- Associated Editor of a special issue of *Advances in Space Research* (2005), devoted to the proceedings of Session *NEO Impact Hazards on Earth and Other Solar System Bodies*, at the COSPAR meeting in Paris (2004)
- Associated Editor of a special issue of *Advances in space Research* (2007) devoted to the proceedings of Session *Small Bodies Exploration: Past, Present and future Missions to Comets and Asteroids*, at the COSPAR meeting in Beijing (2006)

Organization of Meetings and Courses

- Co-Convener of the *Interpretation of observational data using spectropolarimetric techniques* session, European Planetary Conference, Berlin, Germany (2018).

- Co-Convener of the *Interpretation of observational data using spectropolarimetric techniques* session, European Planetary Conference, Riga, Latvia (2017).
- Co-Convener of the *Asteroid Science in the Gaia Era* session, European Planetary Conference, Cascais, Portugal (2014).
- Organizer of the Session *What do we really know about asteroid compositions?* in the Third Meeting of the *Asia Oceania Geosciences Society* (Singapore, 2006).
- Organizer of the Session *Asteroid Science in the Hayabusa Era* in the Second Meeting of the *Asia Oceania Geosciences Society* (Singapore, 2005).
- Co-Director of the *International School of Space Chemistry*, Erice (Italy), June 17-25, 2001.
- Organizer of the Torino IMPACT Workshop, in Torino (Italy) (1999).
- Organizer of the IV Course of the "Scuola Nazionale di Astrofisica", (1996).

Invited Reviews and Talks at Meetings:

- "The identification of Asteroid Families", XVIII Ecole de Goutelas, Goutelas dans le Forez, France (1994).
- "Polarimetry", International School of Space Science (L'Aquila, 1995).
- "Structure and Inventory of the Asteroid Main Belt Population", Asteroids, Comets, Meteors 1996 meeting, Versailles, France (1996).
- "Asteroid Families", 5th Catastrophic Disruption Workshop, Timberline Lodge, Mt. Hood, Oregon (1998).
- "Minor Bodies: Spectral Gradients and Relationships with Meteorites", From Dust to Terrestrial Planets ISSI Workshop, Bern, Switzerland (1999).

- "Physical Properties of Near-Earth Objects: Open Problems", 33th COSPAR Scientific Assembly, Warsaw, Poland (2000)
- "Asteroids as Origins of Meteoritic Materials", Salting the Early Soup: Trace Nuclei from Stars to the solar System Workshop, Torino, Italy
- "Osservazioni di near-Earth objects dallo spazio nell'IR termico", Convegno Nazionale di Astronomia Infrarossa, Perugia (Italy) (2001).
- "Asteroid Families as Probes to Interiors", Workshop *Interior Structures of Small Bodies*, Meudon, France (2002).
- "Rationale and possible options for a dedicated space-based observatory for NEOs", *COSPAR Scientific assembly*, Houston, USA (2002).
- "Asteroid Families as Probes to Interiors", International Workshop *Interior Structures of Small Bodies*, Meudon, Francia (2002).
- "Asteroid Families", *6th Catastrophic Disruption Workshop*, Cannes, France (2003).
- "Ground-based optical observations of asteroids", *IAU General Assembly, Joint Discussion 19*, Sydney, Australia (2003).
- "NERO: General Concept of a NEO Radiometric Observatory", *35th COSPAR Scientific Assembly*, Paris, France (2004).
- "Asteroid Families", International School of space Science (L'Aquila, 2004).
- "Observations of Minor Planets with GAIA", International School of Space Science (L'Aquila, 2004).
- "GAIA observations of asteroids: sizes, taxonomy, shapes and spin properties", *The Three Dimensional Universe with Gaia*, Paris-Meudon, France (2004).
- "The expected role of GAIA for asteroid science", *Asia Oceania Geosciences Society 2nd Annual Meeting*, Singapore, (2005).

- “Some input from Polarimetry”, *Asia Oceania Geosciences Society 3rd Annual Meeting*, Singapore, (2006).
- “Asteroid science with Gaia: sizes, spin properties, overall shapes and taxonomy”, *36th COSPAR Scientific Assembly*, Beijing, China (2006).
- “Asteroid Families”, *7th Catastrophic Disruption Workshop*, Alicante, Spain (2007).
- “Asteroid shapes: From LASPA to Current Ideas”, *International Workshop on Paolo Farinella (1953-2000): The Scientist and the Man*, Pisa, Italy (2010).
- “Minor bodies: small actors in Solar System’s history”, *Schiaparelli and his legacy. Symposium*, Milano, Italy (2010).
- “Recent results in asteroid Polarimetry”, *Regolith on Solar System bodies*, Meudon, France (2010).
- “Photometric and Polarimetric projects for Asteroid Science using small telescopes”, Belgrade, Serbia (2011).
- “The importance of Gaia BP/RP for asteroid science”, *ASSG 2013: Asteroid Spectroscopy in Support of Gaia*, Nice, France, (2013).
- “Asteroid Polarimetry: State of Art and Perspectives”, *Polarimetry of Planetary Systems*, Firenze, Italy (2013)
- “Physical properties of asteroids from Gaia data”, *Asteroids, Comets, Meteors 2014* meeting, Helsinki, Finland (2014).
- “The interesting case of the Watsonia family”, *Stardust ITN - Local training workshop: Collisions in the Solar system*, Belgrade, Serbia, (2015).
- “Asteroid albedos: the role of Polarimetry”, *TherMoPS II* meeting, Tenerife, Spain, (2015).
- “Qualche buona ragione per voler sviluppare un sistema coordinato di osservazioni di meteore e fireballs in Italia”, *PRISMA day*, Firenze (2017).

- “On the synergy of polarimetry and spectroscopy for the physical characterization of the asteroids”, European Planetary Science Conference 2017, Riga, Latvia (2017).
- “The Gaia revolution in asteroid science”, International Symposium for Lunar and Planetary Sciences, Macau, China (2018).
- “The new Gaia era in asteroid science”, International conference Atmosphereless Solar System bodies in the Space Exploration Era, Kharkiv, Ukraine, (2018).
- “Finding asteroid families with AMC”, International conference 2018AMC₇₀, Pisa, Italy (2018).
- “Asteroid polarimetry: Recent results”, International workshop “*Dynamics and Physics of asteroids, TNOs and natural satellites in the new era of Gaia data*”, Antalya, Turkey (2019).
- “How to determine the physical properties of asteroids”, Workshop *Asteroid Exploration and Exploitation Stardust-R Global Virtual Workshop I*, (organized in Pisa, Italy), (2020).

Public outreach activities

- Several public conferences and media interviews, mostly in Italy, but also in other countries (Switzerland, Spain)
- Co-author of the book *The asteroid Hazard*, (an ESA Communication Production, co-sponsored by the Italian *Regione Piemonte*) (2009)
- Teacher for the cycle of lectures CIELO@SCUOLA (2012)

Other Activities:

- Co-investigator in two approved programs using the *Hubble Space Telescope*.
- Collaboration in the development and testing of the UBVRI photopolarimeter of the Osservatorio Astronomico di Torino (1990).
- Over the years, member of the *Scientific Organizing Committee* of several national and international meetings and workshops.

Honours

- Asteroid 3857 is named Cellino, as an acknowledgement of the research activities mentioned above