Prot. 68/H

Technical and Financial Report of the School

" The heliospheric space plasma physics in the era of multipoint space missions"

Organized by Consorzio Area di Ricerca in Astrogeofisica, Istituto Nazionale di Geofisica e Vulcanologia, Istituto Nazionale di Astrofisica, Università dell'Aquila, Dipartimento di Scienze Fisiche e Chimiche, the school "The heliospheric space plasma physics in the era of multipoint space missions" took place at the Palazzo Camponeschi of the University of L'Aquila (Italy) during 18 – 22 May 2026. It was directed by Prof. F. Berrilli (University of Rome Tor Vergata, Italy), Dr. G. Consolini (Istituto Nazionale di Astrofisica, Italy), and Prof. W.H. Matthaeus (University of Delaware, Delaware, USA). The school was further supported by Space Weather Italian Community (SWICo), European Space Weather and Space Climate Association (E-SWAN), International Union of Geodesy and Geophysics (IUGG), International Association of Geomagnetism and Aeronomy (IAGA), Scientific Committee on Solar-Terrestrial Physics (SCOSTEP).

The course consisted of 14 lectures of 90-min length and 2 lectures of 45-min length (including questions and discussion), given by 15 leading scientists of the sector (9 from European institutions 4 from USA and 1 from South Africa), providing a comprehensive introduction on the heliospheric space plasma physics, with particular emphasis on the role of multipoint space missions in studying multi-scale phenomena. The unifying thread of the entire program was the need to move beyond the limitations of single-spacecraft observations through the combined use of multiple probes, capable of providing simultaneous information from different points in space. A first group of lectures addressed turbulence in the solar wind and in space plasma, covering multi-spacecraft measurements of fundamental turbulence properties, including both the progress achieved and the problems that remain open. Related lectures examined anisotropies in solar wind turbulence through numerical simulations compared with multipoint observations, as well as new multipoint techniques for understanding turbulence in the heliosphere. A second thematic strand concerned solar and coronal magnetism. This included the diagnostics of coronal magnetization through scattering polarization, and an exploration of how the Sun's magnetic field can be probed from multiple viewpoints with the help of the Solar Orbiter mission. This was complemented by lectures on the active Sun, covering magnetic fields, flares, and surface organization, and on chromospheric variability across timescales ranging from seconds to centuries. A third thematic axis dealt with kinetic processes and magnetic reconnection in space plasmas. Topics included the transition from kinetic to fluid scales in space plasmas, with emphasis on the quantities that require multipoint information; magnetic reconnection in space plasmas, including current and future perspectives offered by multipoint and multiscale missions; multi-spacecraft analysis methods, framed as the beginning of a new era in multiscale science; and the application of magnetic field line topology in space plasmas. A fourth group of lectures focused on missions and instruments dedicated to multipoint heliospheric research. This included a presentation of a multipoint, multiscale observatory mission for characterizing turbulence, along with a related lecture on magnetic field reconstruction and power estimation, with extensions to future multipoint missions; an overview of an ESA M7 candidate mission ("Plasma Observatory") and NASA-Helioswarm; and a discussion,

delivered online, on the role of multipoint space missions in clarifying multi-scale processes in space plasmas. Finally, one lecture addressed plasma-dust coupling in the heliosphere, broadening the scope of topics covered beyond the ionized plasma component alone. Alongside the main scientific program, the school included two complementary components: a series of student presentation sessions (held across several days, for a total of 20 presentations), and an outreach and teaching event aimed at secondary school teachers, dedicated to teaching, research, and communication in the field of plasma physics and heliophysics. All lessons will also be available at the school's website: https://www.astrogeofisica.it/hspp

The course was attended by 44 students selected based on their curriculum: 21 were from Italy, 7 from India, 3 from France, 2 from USA, 2 from UK, 1 from Belgium, China, Georgia, Germany, Greece, Hungary, Portugal, Spain and Sweden. Additionally, 25 of them were PhD students, 12 were Postdoc Researchers, Research Assistants and Researchers, 6 were Master's degree students, and 1 was Graduate student. The Course took place in a friendly atmosphere with continuous opportunities for close interactions among students and lecturers, also during social events (coffee breaks were provided by the school organization, as well as two cultural events aimed at team building among the participants through the discovery of the area from a social, architectural, and historical perspective). Additionally, specific sessions of the school (2 sessions of 60-min) were dedicated to students' presentations and networking with 33 students who agreed to deliver a brief presentation of themselves and their interests, and 1 session of 1 hour for open discussion.

The E-SWAN financial support was used to allow the participation of a Master's student, who had provided a valid reason for requesting financial support and had an adequate academic record.

Attendees of the course on

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