# International Association of Geomagnetism and Aeronomy

# (IUGG)

## Activity Report - Year 2021

**Delegate: U. Villante**

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## 1. Introduction.

IAGA is concerned with the understanding and knowledge that result from studies of the magnetic and electrical properties of:

- the Earth's core, mantle and crust
- the middle and upper atmosphere
- the ionosphere and the magnetosphere
- the Sun, the solar wind, the planets and interplanetary bodies

and their possible interconnections.

Research activities in these fields are developed in Italy at several universities and major national research organizations, such as the National Institute of Geophysics and Volcanology (INGV), the National Institute for Astrophysics (INAF), the National Research Council (CNR). These activities are usually conducted in the frame of international projects and collaborations and in the context of the traditional Divisions, Interdivisional Committees and Working Groups of IAGA. They involve relevant numbers of researchers, technicians, doctoral students; this broad involvement of institutions, facilities and networks testifies the high degree of interdisciplinarity and the need for a relevant expertise.

IAGA-Italia promotes the coordination of such activities, the development of new ones, the organization of workshops, meetings and schools. For these scopes, the IAGA-Italia community is coordinated by a National Committee, currently composed as follows:

**IAGA Italian Committee**

President: U. Villante: University of L'Aquila – National Delegate.

Members:

- L. Vigliotti: CNR/ISMAR, Bologna – Vice-Delegate, Coordinator Division I "Internal Magnetic Field";
- M. Pezzopane: INGV, Roma, - Coordinator Division II "Aeronomic Phenomena";
- G. Consolini: INAF-IAPS,Roma, - Coordinator Division III "Magnetospheric Phenomena";

- R. Bruno: INAF-IAPS Roma, - Coordinator Division IV “Solar Wind and Interplanetary Magnetic Field”;
- S.Lepidi: INGV, L'Aquila, - Coordinator Division V “Geomagnetic Observatories, Surveys, and Analyses”;
- A. Siniscalchi: University of Bari, - Coordinator Division VI “Electromagnetic Induction in the Earth and Planetary Bodies”;
- A. De Santis: INGV, Roma, - Coordinator Interdivisional Commission on “History”;
- F. Berrilli: University of Tor Vergata, - Coordinator Interdivisional Commission on “Education and Outreach”.

IAGA-Italia has also its own website at http://www.iagaitalia.it for the dissemination of data, news and documentation related to IAGA.

## 2. Main activities carried on by IAGA-Italia during 2021.

**a) Management of Observatories and related activities.**

- Displacement and management of a new continuous magnetotelluric monitoring station in the Gargano Promontory.

- Geomagnetic field variations monitoring at Talos Dome, a remote site on the Antarctic plateau, outside the permanent Observatories, by a self-sufficient system developed at the technological infrastructure of the INGV laboratories, installed on December 2020 and working all the year 2021 in the frame of PNRA16_00204 Project.

- Management of magnetic observatories at Duronia, Castello Tesino, Lampedusa (all three in Italy), Mario Zucchelli (Antarctica, 74.4 S, 164.1 E), Concordia (Antarctica, 75.1 S, 123.2 E) and publication of yearbooks, bulletins, and K indices. Management of magnetic stations at L’Aquila and Gagliano (both in Italy).

- Management of the permanent magnetic network of Etna volcano area, with the aim to detect and isolate local magnetic variations related to volcanic activity.

- Management of SEGMA (South European Geomagnetic Array) and ULF magnetic stations at Terra Nova Bay and Concordia (Antarctica.

- Management of paleomagnetic laboratory at Rome (INGV), Peveragno (Ciman-ALP CIMAN - Centro Interuniversitario di Magnetismo Naturale "Roberto Lanza”, Universities of Milano, Torino, Urbino, Parma, RomaTre, Chieti-Pescara, and INRIM Institute of Turin), Bologna (ISMAR-CNR).

- Management of radars of the SuperDARN international network at Concordia station (Antarctica, 75.1 S, 123.2 E).

- Management of the Italian cosmic ray observatory of Rome, SVIRCO, and publication of monthly/annual reports of cosmic ray measurements, multiplicity and diurnal wave.

Data are also provided in real time to the Neutron Monitor Database web site (www.nmdb.eu) and to ESA SSA Space Radiation Expert Service Centre (swe.ssa.esa.int/space-radiation) for space weather applications.

- Management of ITACA$^2$ auroral all-sky camera at Ny-Alesund (Svalbard). This is the Italian contribution to MIRACLE network.

- Management of four AIS-INGV ionosondes: two in Italy (Rome and Gibilmanna) and two in Argentina (San Miguel de Tucumán and Bahia Blanca). One DPS4 digisonde is managed in Italy (Rome).

- Managements of multi-constellation receivers for measuring TEC and ionospheric scintillations at Baia Terra Nova, Concordia and SANAE IV (in collaboration with SANSA) (Antarctica), at Ny Alesund and Longyearbyen (Svalbard, Norvegia), Lampedusa and Rome (Italy), Tucumán (Argentina), Crete (Greece), Kilifi (Kenya) (in collaboration with Embry-Riddle Aeronautical University and Pwani University), Sao Paulo (Brazil) (in collaboration with INPE) and Nicosia (Cyprus) (in collaboration with Fredrick University).

- Management of continuous magnetotelluric monitoring in a site in Southern Italy (Val d'Agri).

- Management of DCE and DCN ionospheric radars of the SuperDARN international network at Concordia station (Antarctica, 75.1 S, 123.2 E).

- MoU for the installation of a new station has been established between INGV and Centre For Atmospheric Research - National Space Research and Development Agency (Nigeria).

- MoU for the installation of a new station has been established between INGV and MIST (Bangladesh).

- National magnetic cartography: the complete survey scheduled for 2020 and suspended due to COVID-19 pandemic was carried on and almost finished

- New installation of GNSS receivers for ionospheric scintillation monitoring in Ushuaia (Argentina) in collaboration with the Argentinian National Meteorological Service and in Tucuman (Argentina) in collaboration with Universidad Nacional de TUcuman (UNT).

- Plan of an instrumental upgrade at the Italian geomagnetic observatories.

- Planning activity for the realization of a new ionospheric observatory (ionosonde + GNSS receiver for ionospheric scintillation) in the Broglio Space Center (BSC, Malindi, Kenya) in collaboration with Italian Space Agency.

- Participation to the activities of the International Consortium ULTIMA (Ultra Large

Terrestrial International Magnetic Array).

- Survey for the installation of a new digisonde in Lampedusa (Italy).

- Underwater monitoring of the geomagnetic field in portual environment (high artificial noise) and development of the singularity measurements technique for the detection of local anomalies due to hostile operators (anti-intrusion system, anti-terrorism purposes, Min. Difesa financing) in the frame of the LAMA2.0 project.

**b) Projects of interest in the framework of IAGA.**
IAGA-Italia community is involved in several international programs such as:

- **AMUSED.** A MUltidisciplinary Study of past global climatc changes from continental and marine archives in the MeDiterranean region (Progetto Strategico dipartimentale INGV, sezione Ambiente).

- **ASI/CUSP** The CUbesat Solar Polarimeter (CUSP) project has the goal to measure the linear polarization of X rays during solar flares in order to improve the knowledge of physical phenomena responsible for the acceleration of particles originated from the Sun impacting the Earth.

- **ASPIS/CAESAR.** Realization of the ASPIS prototype data center in SSDC for the Italian community involved in Space Weather and Heliophysics Science. It includes the multidisciplinary studies of the chain of Space Weather phenomena occurring from the Sun to the Interplanetary medium, solar wind-magnetospheres-ionospheres at the Earth and the planets, as well as, cosmic rays modulation and impact of space weather events on technological and anthropic systems.

- **ASI-Helianthus.** Feasibility Study (Phase-A) for a Space Weather mission with “Solar Photonic Propulsion” (solar sail). INAF leads the definition of the strawman payload comprising a suite with “in situ” and “remote-sensing” instruments.

- **ASI/HENON** HENON will realize a quantum improvement in our capabilities to predict Space Weather, by proving that a revolutionary extension of the forecasting horizon can be enabled by the use of Distant Retrograde Orbit (DRO), which has never been explored before.

- **ASI/SEE** The Cubesat mission Sun CubE OnE (SEE) deals with the investigation of Gamma and X-ray fluxes and UV (Mg II Imager) solar emission to support studies in Sun-Earth interaction and Space Weather.

- **CHIMERA** (CryptotepHra In Marine sEquences of the Ross Sea, Antarctica: implications and potential applications). PNRA.

- **COLLAPSE** (Cook Glacier-Ocean system, sea LeveL and Antarctic Past Stability), PNRA19_00022.

- **Convenzione INGV - ARPA Lazio.** Analisi del particolato atmosferico mediante studio fisico con correlazione chimica mediante utilizzo tecniche magnetiche, (Ente finanziatore: ARPA Lazio).

- **DRAGON5 2020 – 2024** international project (ID. 59236) " The cross-calibration and validation of CSES/Swarm magnetic field and plasma data" in the frame of the 2020-2024 cooperation between ESA and NRSCC of China (https://eo4society.esa.int/2020/02/20/dragon-5-cooperation-call-for-proposals/).

- **EMSO and EPOS ERICs.** Some of the IAGA activities are performed within the framework of these two European Research Infrastructure Consortia that have their main centre at INGV.

- **EoGu_Astro.** The middle Eocene orbitally driven climate record at Gubbio (Umbrian Appenines, Italy): integrated astrochronology and environmental impact. (Ente finanziatore: Istituto Nazionale di Geofisica e Vulcanologia (INGV) ) Date: 2020-2021

- **EPOS**, TCS Multiscale Laboratories, EPOS MIUR.

- **ESA-BEPI-COLOMBO**, the community participates with several PI-ships MPO/SIMBIO_SYS, MPO/SERENA, MPO/ISA, MPO/MORE) and CoI-ships (MPO/SIXS, MPO/PHEBUS e MMO/MPPE).

- **ESA-Cluster**, the community participates with several CoI-ships for the ion spectrometer, CIS, and actively in the analysis of data and related scientific works.

- **ESA-PROBA-3**, the community participates with one Lead CoI-ship and several CoI-ships for the coronograph ASPIICS.

- **ESA-Solar Orbiter**, the community participates with one PI-ship and several CoI-ships for the coronograph spectrometer METIS, one CoPI-ship and several CoI-ships for the plasma suite SWA.

- **ESA-Space Situational Awareness (SSA) Programme**. (contract no. 4000113184/15/D/MRP).

- **ESA-Response to the call for F mission**, the community is proposing the Debye project with a PI-ship (PDP) at INAF-IAPS and several CoI-ship for PDP related studies and mission science support.

- **ESA-Variability of Ionospheric Plasma (VIP) Swarm + 4DIonosphere**, AO/1-9660/19/I-DT – 4DIonosphere, to exploit the Swarm data to address the understanding of climate/weather in the ionosphere (under quiescent space climate/weather, extreme weather).

- **ESA for the "Campaign: Nanosatellites for Space Weather Monitoring"** called "CUBE (CME Catcher Carousel)" (IDEA: I-2021-04591) – Cubesat mission selected for Implementation which will study the energy transfer from the magnetopause to the ionosphere during reconnection process.

- **EST** (European Solar Telescope), is a ESFRI European Project; the community participates for the design and realization of several subsystems, including: Broad Band Imager, Spectropolarimeter, Heat rejector, Multi-Conjugate Adaptive Optics, Telescope Control, Data Handling and VO, with the leadership in some of these.

- **FWF** (Austrian Science Fundation). Cyclostratigraphy and the astronomical time scale for the Tethyan Campanian (Late Cretaceous).

- **GENIUS** (GNSS TEC and Scintillation monitoring under the Cusp), project funded by Svalbard Integrated Arctic Earth Observing System (SIOS).

- **GRAPE** (GNSS Research and Application for Polar Environment) Expert Group funded by SCAR.

- **H2020-MSCA-RISE-2018.** "BE ARCHAEO-Beyond Archaeology: An advanced approach linking East to West through science, field archaeology, interactive museum experiences". 2019-2023.

- **INGV Department Strategic Project 2019 (Earthquake Department) FURTHER** (The role of **F**l**U**ids in the p**R**epara**T**ory p**H**ase of **E**a**R**thquakes in Southern Apennines), in which a WP addresses the study of the different geolayers coupling (LAIC) before intermediate-large earthquakes using ground (seismic), atmospheric and satellite (magnetic field and plasma density) data.

- **INGV Strategic Project MACMAP** (A Multidisciplinary Analysis of Climate change indicators in the Mediterranean And Polar regions) in which a task addresses the identification of possible correlations between long-term trends in ionospheric/thermospheric parameters and the troposphere.

- **INGV Department Strategic Project 2019 (Environment Department): TROPOMAG** - Influence of geomagnetic storms on the TROPOsphere dynamics: Can the Earth's MAGnetic field be considered a proxy of climate changes?

- **INGV Department Strategic Project:** The middle Eocene orbitally driven climate record at Gubbio (Umbrian Apennines, Italy): integrated astrochronology and environmental impact (EoGu_astro).

- **INGV Institutional Project "Pianeta Dinamico 2021-2022"**. Subtask A1 SINFONIA: Ionospheric and Atmospheric variations related to strong energetic natural phenomena.

- **INGV Institutional Project "Pianeta Dinamico 2021-2022".** Theme 8 - **ATTEMPT**: integr**AT**ed sys**TE**m for **M**ulti-hazard from s**P**ace over medi**T**erranean.

- **INGV Institutional Project "Pianeta Dinamico 2021-2022"**. Theme 3 - **SERENA**: Space weather and climate change: the Solar wind - Earth's magnetosphere Relationships and their Effects on ioNosphere, and upper and lower Atmosphere at various temporal and spatial scales.

- **INGV Institutional Project "Pianeta Dinamico 2021-2022"**. Theme 5 - **CHOPIN**: volCano-atmospHereiOnosPhere connection.

- **INFRAIA** (2021-2025) Progetto dedicato all'integrazione in un'unica infrastruttura federata delle infrastrutture di ricerca europee, e di alcune altre extra-europee, dedicate al monitoraggio e allo studio e modellazione della plasmasfera, ionosfera e termosfera.

- **IRIDYA** (Integrated Reconstruction of Ice sheet DYnamics during late quaternary Arctic climatic transitions), PNRA-PROGRAMMA DI RICERCHE IN ARTICO.

- **ISSI** Project "Multi-technique characterization of near-Earth space environment".

- **ISSI** Project "Current Sheets, Turbulence, Structures and Particle Acceleration in the Heliosphere".

- **ISSI** Project "Complex Systems Perspectives Pertaining top the Research of the Near-Earth Electromagnetic Environment".

- **ISSI** Project "Step forward in solar flare and coronal mass ejection (CME) forecasting".

- **ISSI-Bj** project "The electromagnetic data validation and scientific application research based on CSES satellite" (http://www.ief.ac.cn/laimc_issi_bj/team.php.html)

- **LIMADOU SCIENZA +**: An Italian Space Agency funded project for exploiting CSES (Chinese Seismo-EM satellite) satellite electromagnetic data, which is the continuation of the former "LIMADOU SCIENZA" project. The aim of the project is the investigation of the Lithosphere-Ionosphere-Atmosphere-Magnetosphere coupling in search for earthquake related anomalies, and the characterisation of Magnetosphere-Ionosphere system in connection with solar activity.

- **MeCeMiBaCa.** The record of Meso-Cenozoic Milankovitch cycles in the Basque-Cantabrian area: astrochronology and environmental impact of orbitally driven climate change. Date: 2021-2024 Ente finanziatore: Ministerio de Ciencia, Innovación y Universidades, MICINN (Spain).

- **MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD, (Spain).** PALEOTRANS (Paleoenvironmental dynamics of transitional settings from Cretaceous to Eocene in the Southcentral Pyrenees)

- **MIUR PRIN 2017: 2019-2022.** CEI6: Circumterrestrial Environment: Impact of Sun-Earth Interaction.

- **MIUR PRIN 2017: 2019: 2022** Detection and tracking of crustal fluid by multi-parametric methodologies and technologies.

- **NORISK**: New observatory for real-time ionospheric sounding over Kenya. Funded by ASI.

- **PECASUS** (Partnership for Excellence in Civil Aviation Space weather User Services) global space weather service center designated by ICAO (Council of International Civil Aviation Organization).

- **PITHIA-NRF** (Plasmasphere Ionosphere Thermosphere Integrated Research Environment and Access services: a Network of Research Facilities), Call H2020-02

- **PNRA.** CHIMERA (CryptotepHra In Marine sEquences of the Ross Sea, Antarctica: implications and potential applications).

- **PNRA WHISPER** (West Antarctic Ice Sheet HIstory from Slope Processes – Eastern Ross Sea)

- **PNRA14_00097** - Linea A1 "Osservatorio geomagnetico presso la Stazione Concordia, Dome C, Antartide.

- **PNRA14_00106** - Linea A1 "Osservatorio Geomagnetico a Stazione Mario Zucchelli".

- **PNRA 14/110** "Upper Atmosphere Observation and Space Weather".

- **PNRA 14/00133** "Bipolar Ionospheric Scintillation and TEC".

- **PNRA 14/00085** “SuperDARN: HF ionospheric radars, DCE e DCN, at Concordia” (Antarctica).

- **PNRA 15/00135 “**"ESCAPE: Solar Coronography fron Antarctica for Space Weather studies".

- **PNRA16_00204 “**Temporary magnetometer network for longitudinal and latitudinal monitoring in Antarctica".

- **PNRA18_00289** “Space weather in Polar Ionosphere: the Role of Turbulence” (SPIRiT)

- **PNRA** National Antarctic Data Center – Project to define the data and metadata infrastructure for Antarctica observations, 2019-2021

- **PON InSea "**Iniziative in Supporto al consolidamento e potenziamento dell'infrastruttura EMSO e delle sue attività", 2019 – 2022. Potenziamento delle infrastrutture a mare e in prossimità della costa italiana con deposizione di SMART cable per scopi di monitoraggio geofisico e marino.

- **PON-GRINT.** Infrastruttura di ricerca italiana per le Geoscienze (PON Ricerca e Innovazione 2014-2020) con potenziamento dei punti osservativi geofisici e ambientali sul territorio nazionale.

- **PROGETTO DI RICERCA LIBERA INGV (2022-2023)**, PaleoSecular Variations of the GEOmagnetic FIeld from the western SIcily Channel (PSVGEOFISIC).

- **ReCliAME.** Climatic-environmental feedback under global warming conditions: lessons from the Maastrichtian-Eocene of the Iberian peninsula. Ministerio de Economía y Competitividad, (Spain), Univ. Pais Vasco, UPV/EHU

- **STREAM.** Evoluzione tardo quaternaria delle interazioni oceano-calotta glaciale: il record dal margine continentale del Mare di Ross (Antartide). (Progetto bilaterale Italia-Korea di Grande Rilevanza finanziato dal MAE).

- **SWERTO** (Space-Weather at the University of Rome Tor Vergata) financed by LazioInnova Regione Lazio. On-line data-base for space (e.g., PAMELA, ALTEA) or ground-based instruments (e.g., IBIS, MOTH) relevant to the determination of Space-Weather conditions (www.spaceweather.roma2.infn.it).

- **SWEATERS** (Space WEAThER Radiation Sensors) An Italian Space Agency funded project (ASI contract 2020-14-HH.0 ) for ENA (Energetic Neutral Atoms) instrument development devoted to Space Weather monitoring via ENA detection technique.

- **TREASURE** Training REsearch and Applications network to Support the Ultimate Real time high accuracy EGNSS solution), is a prestigious Marie Skłodowska-Curie Actions (MSCA) Innovative Training Network (ITN), funded through the European Union's Horizon 2020 Research and Innovation Programme.

- **TROPOMAG** Progetto Strategico Dipartimentale (INGV-Ambiente) per il quadriennio 2021-2024 (studio sugli effetti nella bassa troposfera delle tempeste geomagnetiche).

As a consequence of the persistent COVID-19 pandemic, as for the previous year, many scheduled activities have been delayed; during 2021, most of the participations in international conferences took place via the web.

## 3. Italian attendance to international conferences

- European Geosciences Union General Assembly (Vienna, Austria; on line).
- AGU Fall meeting (New Orleans, USA; on line).
- Swarm 11th DQW (Athens, Greece).
- Swarm Science Workshop, ESA, Frascati (virtual).
- SuperDarn Workshop, SANSA, South Africa (virtual).
- 107° Congresso Nazionale della Società Italiana di Fisica (on line).
- 17th European Space Weather Week (Glasgow, UK; on line).
- International Union of Radio Science General Assembly and Scientific Symposium (Roma, Italy; presence and on line).
- Joint Scientific Assembly IAGA-IASPEI (India; on line).
- Space Weather Workshop in the Frame of the 9th Annual IEEE International Conference on Wireless for Space and Extreme Environments (WISEE 2021) (virtual).
- 5th International Workshop of CSES Mission, Guiyang (China).
- 15th China International Geo-Electromagnetic Workshop (CIGEW 2021), Changchun (Jilin, China).
- 43 COSPAR 2021 Scientific Assembly (Australia; on line).
- Statistical Studies and Machine Learning In Space Science (USA, online).
- UK National Astronomy Meeting (UK, online).
- Solar wind-Magnetosphere Interaction Workshop (USA, online).
- Arcetri 2021 Workshop on Plasma Astrophysics (Firenze, Italy).
- SR 40 Forty Years of Stochastic Resonance (Perugia, Italy).
- European Solar Physics Meeting 16 (on line).

## 4. Education and Outreach.

IAGa-Italys pays particular attention to educational aspects and outreach.

**a) Collaboration with the *International School of Space Science*.**

In collaboration with other institutions and within the framework of the International School of Space Science (L'Aquila), directed by the Italian delegate, the IAGA-Italy community has launched, for the next three years, a program of schools dedicated to the training of young researchers in the area of the Solar Terrestrial Physics and Space Weather. The course

- Dynamical Systems and Machine Learning Approaches to Sun-Earth Relations

(originally scheduled in 2020, has been postponed to February, 2021 (web – school).
Directors: G. Consolini, D. Del Moro

and two courses have been planned during 2022:

- The different spatio- scales of the solar magnetism.

April, 2022.
Directors: F. Zuccarello, L. Bellot Rubio

- Radiation belt dynamics and remote sensing of the Earth's plasmasphere
September, 2022.
Directors: J. Lichtenberger, G. Reeves, M. Vellante.

**b) Collaboration with the Lincean Academy (Accademia Nazionale dei Lincei)**
As part of the National Days for the Environment organized by the Lincean Academy, the conference "Solar Activity and its Impact on the Circum-Terrestrial and Terrestrial Environment" was held in December 2021. The conference was open to secondary school students, journalists and scientists interested in solar activity. The conference was organized by the Coordinator of the Interdivisional Commission on "Education and Outreach". (https://www.lincei.it/en/node/9020).

**c) Collaboration with the *Space Weather Italian Community*.**
IAGA – Italia continues to promote IAGA scientific interests and material to the national community. This activity is supported by the different institutions (universities, observatories, institutes) through individual initiatives towards the general public and towards high-school and secondary school students. In the field of the Space Weather, on a national level, the activity is coordinated by the *Space Weather Italian Community* (*SWICo*; www.swico.it) which organized monthly webinars on topics mainly related to Space Weather and Sun-Earth relations. The *SWICo* group of Outreach and Media Public Relations is composed of: Lucilla Alfonsi (INGV), Raffaella D'Amicis (INAF-IAPS), Paola De Michelis (INGV; coordinator), Luca Giovannelli (UNITOV), Antonella Greco (UNICAL), Mauro Messerotti (INAF-OATS), Paolo Romano (INAF-UNICT).

Webinars held:

- "Assessing Machine Learning Techniques for Identifying Field Line Resonance Frequencies from Cross-Phase Spectra", Raffaello Foldes (UNIAQ).

- "TITIPy: a Python tool for the calculation and mapping of topside ionosphere indices, and for the GPS loss of lock identification and characterization", Alessio Pignaliberi (UNIBO).

- "Geoelectric field evaluation during the September, 2017 Geomagnetic Storm: MA.I.GIC. model", Mirko Piersanti (INAF-IAPS).

- "Assessing Machine Learning Techniques for Identifying Field Line Resonance Frequencies from Cross-Phase Spectra", Raffaello Foldes (UNIAQ).

- "TITIPy: a Python tool for the calculation and mapping of topside ionosphere indices, and for the GPS loss of lock identification and characterization", Alessio Pignaliberi (INGV).

- "Geoelectric field evaluation during the September, 2017 Geomagnetic Storm: MA.I.GIC. model", Mirko Piersanti (INAF-IAPS).

- "Chaos and turbulence: is our everyday feeling accurate ?", Tommaso Alberti (INAF-IAPS)

- "A Markovian approach to magnetospheric dynamics", Simone Benella (INAF-IAPS)

- "Lo strumento SERENA in viaggio verso Mercurio a bordo di BepiColombo", Stefano Orsini (INAF-IAPS)

**d) Collaboration with international entities.**

- Eastern Africa Space Weather and GNSS capacity building workshop (21-25 June 2021) organized in collaboration with INGV, ICTP, UNOOSA, Boston College and Pwani University. Directors: Claudio Cesaroni (INGV), Patricia Doehrty (BC), Bruno Nava (ICTP), Joseph Olwendo (PU), Sharafat Gadimova (UNOOSA).

- Estudio y monitoreo de la ionosfera para clima espacial postgraduate course (8 hrs, December 2021) on Space Weather and ionosphere at Universidad Nacional de Tucuman (Argentina). Docenti: Lucilla Alfonsi, Claudio Cesaroni.

## 5. Activities carried on by the Italian Delegate and National Committee during 2021 and impact on the Italian scientific community.

As in the past, the Italian Delegate and the National Committee have developed their activity paying attention mainly to the following aspects: participation of IAGA - Italia to scientific programs and international meetings; development of new initiatives at national level, with particular reference to the cooperation between universities, research institutions and industries; tutoring and training of young researchers and students, encouraging their participation to IAGA activities. In particular, we outline the following activities

a) **Joint Scientific IAGA-IASPEI Assembly 2021** The participation of Italian researchers in the Joint Scientific IAGA-IASPEI Assembly was large and qualified. In particular, several Italians have played the roles of convenors and chairmen in the various divisions. Of course, the remote participation limited the usual possibility of interactions; however, the results of the Assembly, thanks to the good and careful organization, can certainly be positively evaluated. The Italian Delegate actively participated to the Officers and Delegates Meetings

**a) Organization of the 2° Meeting of the Space Weather Italian Community.**

The 2° Meeting of the Space Weather Italian Community will be held in Rome (Agenzia Spaziale Italiana), 9-11 February 2022. As on the occasion of the 1° Meeting, the 2° SWICo Meeting intends to be a moment of encounter and discussion of the entire Italian community engaged in the disciplines in question. It is therefore also open to researchers and technologists who are not members of SWICo and the active participation of students, PhD students and young researchers is particularly encouraged.

## 6. Italian experts with important roles within the Union or within related Commissions and Programs.

- Members of the IAGA National Committee are in the IUGG Network of Italian Experts.

- F. Florindo (INGV) is the chairman of the Working Group I.2 “Paleomagnetism” of the IAGA Division I - Internal Magnetic Fields and President of the Earth Magnetism and Rock Physics Division of European Geophysical Union.

- A. De Santis (INGV) is Member in the ASI Committee on ESA satellite Earth Observation Missions.

- A. Meloni is President of the National Scientific Commission for Antarctica.

- U. Villante (University of L’Aquila) is President of SWICo (Space Weather Italian Community).

- F. Zuccarello (University of Catania), F. Berrilli (University of Rome Tor Vergata), G. Consolini (INAF), M. Messerotti (INAF), R. Tozzi (INGV) and S. Lepidi (INGV) are members of the Directive Board of SWICo (Space Weather Italian Community).

- A. Greco (University of Cosenza), P. De Michelis (INGV), P. Romano (INAF), L. Giovannelli (University of Rome Tor Vergata), L. Alfonsi (INGV), M. Messerotti (INAF) and R. D’Amicis (INAF) are members of the SWICo working group ‘Outreach and Media Public Relations’.

- D. Di Mauro (INGV) is the Italian reference for the Italian magnetic network which contributes to the European network. He also acts as reference for the Italian geomagnetic observatories at Castello Tesino (North Italy), Duronia (Central Italy) and Lampedusa (South Italy).

- G. De Franceschi (INGV) is the leader of the SCAR expert group GRAPE (GNSS Research and Application for Polar Environment). She has been appointed URSI (International Union of Radio Science) delegate to SCAR since 2014. She has been elected URSI Commission G chair for the period 2021-2023. She is the INGV Representative in the National Scientific Committee for Arctic. Lucilla Alfonsi (INGV) is her Deputy.

- V. Romano (INGV) is the Italian co-expert on Space Weather at ONU COPUOS (Committee on the Peaceful Uses of Outer Space), he is National co-coordinator for Italy in ISWI (International Space Weather Initiative), he is the Italian delegate in the Steeering Committee of the PECASUS Consortium, he is the INGV delegate in the COSPAR Panel for Space Weather.

- M. Materassi is the Italian National Delegate to Commission G of URSI (Union Radio-Scientifique Internationale).

- C. Scotto is the Italian National Deputy Delegate to Commission G of URSI (Union Radio-Scientifique Internationale).

- Y. Migoya Orue' (ICTP) is National co-coordinator for Italy in ISWI (International Space Weather Initiative).

- F. Berrilli (University of Rome Tor Vergata) is Delegate for Space Science in ASI Planetary Science Board, and SPIN-IT/CTNA Delegate in "PROTECTION of European assets in and from space" in ASI-H2020 Team.

- R. D'Amicis (INAF-IAPS) is Vice-Chair of the Cospar Capacity Building and CoPI of the Solar Wind Analyser (SWA) onboard Solar Orbiter.

- F. Zuccarello (University of Catania) is member of the Board of the European Solar Physics Division of the European Physics Society.

- B. Nava (ICTP) is Italian member of the International Reference Ionosphere Working Group and Co-Chair, Beacon Satellite Studies Working Group, URSI Commission G.

- M. Vellante is Co-PI of EMMA (European quasi-Meridional Magnetometer Array).

- A. Bemporad (INAF) is the Scientific Discipline Representative in the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP).

- A. Bemporad (INAF), F. Berrilli (UNITOV), P. De Michelis (INGV), M. Laurenza (INAF), F. Marcucci (INAF), S. Orsini (INAF), V. Romano (INGV) are members of the ASI Working Team for the Italian Roadmap for Space Weather.

- M. Pezzopane (INGV) is Italian member of the International Reference Ionosphere Working Group and Co-chair of IAGA WGII-E: Ionospheric irregularities, Fields and Waves.

- I. Coco (INGV) is member of the Electric Field Instrument Science Discussion Group of the Swarm ESA mission, and of the ESA Swarm-CSES working group.

- C. Cesaroni (INGV) is the chair of the URSI Commission G working group "Capacity Building and training" and co-chair of the inter-commission (FCGEH) )working group "Risk and Disaster Management (Inter URSI Commissions)". He is also member of the SWICo working group "Technological developments".

- D. Sabbagh (INGV) has been elected URSI Early Career Representative (ECR) of the Commission G for the years 2021-2026.

- L. Spogli (INGV) is the advisory for the Italian Member of the Meteorology Panel (METPANEL) of the International Civil Aviation Organization (ICAO) in the frame of the Meteorological Information Service Development Working Group (WG-MISD) (now WG-MOG) for Space Weather.

- L. Alfonsi is member of the Polar Expert Group (PEG) of the EU-PolarNet2 project (eu-polarnet.eu/) aiming at establishing a permanent European coordination of polar research.

- A. Milillo (INAF) is InterDisciplinary Scientists of the BepiColombo mission for Mercury's environment.

- M. Piersanti (UnivAQ) is the Italian PI of the " The cross-calibration and validation of CSES/Swarm magnetic field and plasma data" in the frame of the 2020-2024 DRAGON 5 cooperation project (ID. 59236) between ESA and NRSCC of China (https://eo4society.esa.int/2020/02/20/dragon-5-cooperation-call-for-proposals/). He is also is the PI of the calibration/validation of the Electric Field instrument on board CSES-01 satellite in the frame of the SWARM/CSES satellites cal-val group and PI of the commissioning phase of the Electric Field instrument (EFD) on board the satellite CSES-02 in the frame of the CSES-Limadou collaboration.

- R. Bruno (INAF-IAPS) is one of the members of the Scientific Council of ISSI/ISSI-Beijing (2020-2023)
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## 7. Awards and Prizes.

- Award "Franco Mariani". The Award "Franco Mariani", established to honor the memory of a scientific personality of international prestige (former IAGA delegate) and to promote the involvement of young researchers in the disciplines relating to Space Weather has been assigned to dr. Giuseppina Carnevale.

- A. Pignalberi received the Young Scientist Award (YSA) by the International Union of Radio Science (URSI GASS 2021) at the XXXIV General Assembly and Scientific Symposium held in Rome. (https://www.ursi.org/young_scientists.php).

- The INTENS team (P. De Michelis, G. Consolini, M. Pezzopane, A. Pignalberi, I. Coco. F. Giannattasio, R. Tozzi and M. F. Marcucci) was awarded with a mention at the 107$^{th}$ National Congress of the Italian Physical Society, Section 4 "Geophysics and Environmental Physics"; title of the communication "*Ionospheric Turbulence: A Challenge for GPS Loss of Lock Understanding*".

- F. Florindo (INGV) has been elected as Class of Fellows of AGU 2021.

## 8. Concluding remarks.

As for previous years, despite the pandemic, IAGA- Italia pursued its activity supporting the Italian participation in international programs and promoting the involvement of young researchers and doctoral students in the IAGA activities. IAGA-Italia is also pursuing in the organization of specific training paths for young researchers and PhD students. As outlined in previous reports, it is also important to create awareness in the national scientific community about the role that Italy can play internationally on the basis of the remarkable scientific skills and of the availability of high standard instrumentations, cutting edge sensors, advanced technological infrastructure and multiparametric observational networks.

**The IUGG/IAGA Delegate**
**Prof. U. Villante**