International Association of Geomagnetism and Aeronomy

(IUGG)

Activity Report - Year 2020

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 2020.

As a consequence of the COVID-19 pandemic, many scheduled activities have been delayed or moved to another date; during 2020, most of the participations in international conferences took place via the web.

The main activities carried on by IAGA Italia have been the following:

a) International conferences with a relevant Italian participation:

- European Geosciences Union General Assembly (Vienna, Austria; on line).
- AGU General Assembly (S. Francisco, USA; on line).
- 106° Congresso Nazionale della Società Italiana di Fisica (Milano, Italy; on line).
- European Space Weather Symposium (on line).
- 1st Space Weather Workshop at the 8th Annual IEEE International Conference on Wireless for Space and Extreme Environments (on line).
- GRAPE/RESOURCE Online Workshop (on line).
- International Union of Radio Science General Assembly and Scientific Symposium (Roma, Italy).
- 1° Congresso della Space Weather Italian Community (Roma, Italy).
- Annual Meeting of the Astronomische Gesellschaft 2020 (on line, Germany).

b) Management of Observatories and related activities.

- 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 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). A new station was installed in October in Nicosia (Cyprus) in collaboration with Fredrick University. A 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).

- 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).

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

- National magnetic cartography: the complete survey scheduled for 2020 was suspended due to COVID-19 pandemic.

- Participation to the activities of the International Consortium ULTIMA (Ultra Large Terrestrial International Magnetic Array).

- Participation to the Core Proposing Team for the White Paper "Particle Energization in Space Plasmas: Towards a Multi-Point, Multi-Scale Plasma Observatory" in response to the "Call for White Papers for the Voyage 2050 long-term plan in the ESA Science Programme".

- 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.

- South Pole Solar Observatory installed at Amundsen–Scott South Pole Station (NSF project with Italian participation) for the multispectral observation of solar magnetic field and dynamics.

- Antarctica – Italian-French Concordia Station: Installed a coronagraph – AntarctiCor - for the observation of the solar corona and the study of the coronal magnetic field's The book has ben published on 2020, (PNRA).

- Research Topic: "Advances in Space Plasma Turbulence: Theory and Observations", Edited by S. Perri (IAGA member), L. Sorriso-Valvo (IAGA member), A. Tenerani and P. Hellinger.
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- Research Topic: "New Challenges in Space Plasma Physics: Open Questions and Future Mission Concepts", Edited by L. Sorriso-Valvo (IAGA member), A. Retinò, D. Verscharen and CHK Chen.

3. 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 climatE changes from continental and marine archives in the MeDiterranean region (Progetto Strategico dipartimentale INGV, sezione Ambiente).

- **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.

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

- **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

- **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-INTENS** (characterization of IoNospheric TurbulENce level by Swarm constellation), supported by ESA for the characterization of the ionospheric turbulence by means of measurements of the magnetic field and plasma of Swarm satellites.

- **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-TEMPO:** to study the South Atlantic anomaly and its future evolution.

- **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.
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- **ESA VIP Swarm+ 4DIonosphere,** to exploit the Swarm data to address the understanding of climate/weather in the ionosphere (under quiescent space climate/weather, extreme weather).

- **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?

- **INSIEME** (Induced Seismicity in Italy: Estimation, Monitoring, and sEismic risk mitigation), Project supported by the SIR-MIUR research program.

- **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".

- **LIMADOU-SCIENCE**: An Italian Space Agency funded project for studying CSES (Chinese Seismo-EM satellite) satellite electromagnetic data for searching earthquake related anomalies.

- **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 2018.** Oceanic Megatrasforms: a New Class of Plate Boundaries.

- **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.

- **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).

- **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.

- **PON-GRINT.** Infrastruttura di ricerca italiana per le Geoscienze (PON Ricerca e Innovazione 2014-2020).

• **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).

• **SWARM VIP** "Swarm Space Weather Variability of Ionospheric Plasma", University of Oslo – INGV Italy, 2020-2022.

• **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).

• **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.

4. Education 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 following courses will be organized during 2021 – 2022.

• Dynamical Systems and Machine Learning Approaches to Sun-Earth Relations (originally scheduled in 2020 and postponed due to pandemic).
February, 2021 (web – school).
Directors: G. Consolini, D. Del Moro

• The different spatio- scales of the solar magnetism.
April, 2022.
Director: M. Zuccarello

• Radiation belt dynamics and remote sensing of the Earth's plasmasphere
September, 2022.
Director: M. Vellante.

b) 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).

The webinars held (or planned for the next months) are:

- "On the identification of coherent structures in plasma physics: helicity and PVI methods", Antonella Greco (Università della Calabria.

- "Electron Density Fluctuations and Ionospheric Turbulence: a Characterization by Swarm Constellation", Paola De Michelis (INGV).

- "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).

5. Activities carried on by the Italian Delegate and National Committee during 2020 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. It should be stressed that the Italian presence, often with major responsibilities, is particularly active and qualified in international programs devoted to the study of the Earth and the circumterrestrial space, to space missions related to Earth Observations, to the physics of the Sun, to the Interplanetary Space, to the Sun-Earth Relations. In particular, the following activitities hve been promoted.

a) 1° Meeting of the Space Weather Italian Community.

The 1° Meeting of the Space Weather Italian Community, organized and held in Rome (Agenzia Spaziale Italiana), 9 - 10 february, has been attended by a very relevant number of participants. It also offered the opportunity for an open discussion on the future programs in the field of the Space Weather.

b) 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), 29 sept.- 1 oct. 2021. 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.

c) Award "Franco Mariani".

The Award "Franco Mariani" has been established to honor the memory of a scientific personality of international prestige (former IAGA delegate) promoting the involvement of young researchers in the disciplines relating to Space Weather.

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 vice chair for the triennium 2017-2020. 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) and Italian co-coordinator of ISWI (International Space Weather Initiative).

- M. Materassi is the Italian National 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.

- 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.

6. Awards and Prizes.

Two prestigious international awards were assigned to Dario Sabbagh (INGV), member of the INGV Team of the Limadou-Science project: a) the Young Scientist Award (YSA) awarded by the International Union of Radio Science (URSI GASS 2020) at the XXXIII General Assembly and Scientific Symposium; b) the prize conferred by IUGG/EMSEV (Electromagnetic Studies of Earthquakes and Volcanoes) working group for the

presentation "Satellite Electron density variations derived with different backgrounds in different solar conditions" in the “Natural Hazards” session of the AGU.

Other two awards have been conferred by the Italian Physical Society to Angelo De Santis and Luca Spogli, whose presentations were awarded among the best of the conference SIF2020, in the "Geophysics and Physics of the Environment" section.

7. Concluding remarks.

IAGA- Italia pursued its activity mainly supporting the Italian participation in international programs and promoting the involvement of young researchers and doctoral students in the IAGA activities. For this scope, IAGA-Italia has collaborated in the organization of specific training paths for young researchers. 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 and observational networks.

The IUGG/IAGA Delegate
Prof. U. Villante