

IAGA
RESEARCH ACTIVITIES IN GREECE
FOR THE PERIOD 2015-2018

Edited by
Prof. J. Daglis
IAGA National Correspondent

Contributions by:

Division 1: Internal Magnetic Fields

Prof Kanaris Tsinganos

National & Kapodistrian University of Athens and National Observatory of Athens

Division 2: Aeronomic Phenomena

Assoc. Prof. Theodoros Sarris

Democritus University of Thrace

Division 3: Magnetospheric Phenomena

Space Physics Group: Prof. Ioannis A. Daglis , Dr Marina Georgiou, Dr. Christos Tsironis ,
Dr. Ingmar Sandberg , Christos Katsavrias.

National & Kapodistrian University of Athens, Department of Physics,

Dr Anastasios Anastasiadis, Dr Athanasios Papaioannou, Dr Georgios Balasis, Dr Anna
Belehaki and the Ionospheric Group of IAASARS,

National Observatory of Athens

Theodoros Sarris, Associate Professor,

Democritus University of Thrace

Division 4: Solar Wind and Interplanetary Field

Panagiota Preka-Papadema, Assistant Professor, and the ARTEMIS team

National and Kapodistrian University of Athens, Department of Physics

Costas Alissandrakis, Prof. Emeritus of Astrophysics, Alexander Nindos, Assoc. Prof.,
Spiros Patsourakos, Assoc. Professor.

**University of Ioannina, Department of Physics, Section of Astro-geophysics, Laboratory
of Astronomy**

Costis Gontikakis and Manolis Georgoulis, both Senior Researchers.

Research Center for Astronomy and Applied Mathematics of the Academy of Athens

Division 5: Geomagnetic Observatories, Surveys and Analyses

Dr. Georgios Balasis and Prof. Ioannis A. Daglis

National Observatory of Athens / National and Kapodistrian University of Athens

Division 6: Electromagnetic Induction in the Earth and Planetary Bodies

Prof. Konstantinos Kourtidis

Democritus University of Thrace,

Prof. Filippos Vallianatos, Prof. John P. Makris and the TEICR-LGS team

Technological Education Institute of Crete.

Division 1: Internal Magnetic Fields

National & Kapodistrian University of Athens and National Observatory of Athens

Prof Kanaris Tsinganos

Infrastructures:

Radon network for detecting pre-seismic phenomena

We have developed a multiparameter network infrastructure aiming towards the monitoring and thorough study of earthquake precursor phenomena at the high seismicity area of the Western Hellenic Arc (SW Peloponnese, Greece). We conducted a continuous real-time monitoring of Radon accumulation in the ground by using a network of radon sensors. The radon monitoring network consists of three gamma radiation detectors [NaI(Tl) scintillators] placed at Methoni, Kyparissia and Zakynthos and one alpha radiation spectrometer (Kalamata area). All gamma-ray sensors have been placed in the ground at a depth of 1 m. Local meteorological parameters for atmospheric corrections are also continuously monitored and analysed. Radon measurements are performed indirectly by means of gamma ray spectrometry of its radioactive progenies ^{214}Pb and ^{214}Bi (emitted at 351 keV and 609 keV, respectively). The alpha spectrometer was initially used for the inter-calibration of all gamma radiation monitoring stations after their installation.

The first results showed that a number of pre-seismic radon variation anomalies have been observed before several earthquakes ($M > 3.6$). After compensating the daily tidal effects the data showed a clear indication of the dependence of radon release on the earthquake occurrence. The radon increases systematically before the larger events. For example a radon anomaly was predominant before the event of Sep 28, M 5.0 (36.73°N, 21.87°E), 18 km ESE of Methoni. A good correlation can also be seen with the smaller events.

A nine-station seismic array was additionally installed at the Pylos area, in order to detect and accurately locate microseismic events of less than 1.0 R magnitude in the offshore area. At this specific area the absence of stations west of the coast, at the sea area, causes difficulties to detect and accurately locate the low magnitude seismic events only by the use of the National Unified Seismological Network of Greece recording, since both the epicentral distances and the azimuthal gap of these earthquakes are very large. The seismic array assists to the evaluation of the current seismicity at this area and in some cases the identification of a possible foreshock activity.

The method of thermal anomalies in satellite images is also applied in a regular basis as a second tool for evaluation of the Radon increase. According to the Lithosphere-Atmosphere-Ionosphere Coupling (LAIC) model, atmospheric thermal anomalies observed before strong events can be attributed to an increased of the radon concentration. This is also supported by the statistical analysis of AVHRR/NOAA-18 satellite thermal infrared (TIR) daily records. We performed satellite thermal monitoring over the area of SW Hellenic Arc, by analyzing nighttime images of POES polar orbit satellites to verify the correlation of the thermal anomalies and the radon pre-erthquake emission.

Contribution to international associations:

- Member of the SOC of the Solar Orbiter Mission, Metis experiment
- Greek PI of the Proba 3 mission

- Member of the steering committee of the European project ERA-Planet (<http://www.era-planet.eu/>).

Publications:

- Antonucci, (Tsinganos), et al, Metis: the Solar Orbiter visible light and ultraviolet coronal imager, *Astronomy & Astrophysics*, submitted (2018)
- Rouillard, (Tsinganos), et al, Models and Tools for the Solar Orbiter mission, *Astronomy & Astrophysics*, submitted (2018).
- Syntelis, P.; Archontis, V.; Tsinganos, K., Recurrent CME-like Eruptions in Emerging Flux Regions. I. On the Mechanism of Eruptions, *The Astrophysical Journal*, Volume 850, Issue 1, article id. 95, 15 pp. (2017)
- Syntelis, P.; Gontikakis, C.; Patsourakos, S.; Tsinganos, K., The spectroscopic imprint of the pre-eruptive configuration resulting into two major coronal mass ejections, *Astronomy & Astrophysics*, Volume 588, id.A16, 14 pp. (2016)
- Patsourakos, S.; (Tsinganos) et al, The Major Geoeffective Solar Eruptions of 2012 March 7: Comprehensive Sun-to-Earth Analysis, *The Astrophysical Journal*, Volume 817, Issue 1, article id. 14, 21 pp. (2016)
- Stathopoulos, F.; Vives, S.; Damé, L.; Tsinganos, K., Mathematical modelling of the complete metrology of the PROBA-3/ASPIICS formation flying solar coronagraph, *Proceedings of the SPIE*, Volume 10565, id. 105652S 6 pp. (2017).
- Lamy, (Tsinganos) et al, ASPIICS: a giant, white light and emission line coronagraph for the ESA proba-3 formation flight mission, *Proceedings of the SPIE*, Volume 10565, id. 105650T 7 pp. (2017).

Division 2: Aeronomic Phenomena

Democritus University of Thrace

Theodoros Sarris, Associate Professor

International Research Programs:

- Development and launch of DUTHSat-GR01, a CubeSat that was developed as part of the QB50 project to study the Earth's upper atmosphere
- Participation as lead institution in "Daedalus", a candidate mission for ESA's Earth Explorer 10. Daedalus would carry a suite of instruments to provide measurements in a largely unexplored area between the Earth's upper atmosphere and space. Here, intriguing and complex processes govern the deposition, transformation and transport of some of the Sun and solar wind's energy. The aim is to quantify amounts of energy deposited in the upper atmosphere by measuring, for example, effects caused by the electrodynamic processes in this region. The concept is based on a mother satellite, which carries a suite of instruments along with four small satellites carrying a subset of instruments that are released into the atmosphere.
https://www.esa.int/Our_Activities/Observing_the_Earth/Three_Earth_Explorer_ideas_selected

Publications:

- T. Sarris, T. Mpalafoutis, G. Kottaras, A. Psomoulis, I. Vasileiou, A. Papathanasiou, D. Mpaloukidis, I. Nissopoulos, P. Pirnaris, A. Aggelis, and K. Margaronis, DUTHSat: A Greek QB50 nano-satellite for Upper Atmosphere Studies, Hipparchos, ISSN: 1790-9252, Volume 2, Issue 12, 2015.
- L. M. Zelenyi, G. N. Zastenker, A. A. Petrukovich, L. S. Chesalin, V. N. Nazarov, V. I. Prokhorenko, Y. Balazh, K. Kydela, I. Strgarski, M. Slivka, V. A. Gladyshev, I. P. Kirpichev, E. Sarris, T. Sarris, et al., PLASMA-F Experiment: Three Years of On-Orbit Operation, ISSN 0038_0946, Sol. Sys. Res., 2015, Vol. 49, No. 7, pp. 1–24.

Division 3: Magnetospheric Phenomena

National & Kapodistrian University of Athens, Department of Physics

Space Physics Group: Prof. Ioannis A. Daglis (IAD), Dr Marina Georgiou (MG), Dr. Christos Tsironis (CT), Dr. Ingmar Sandberg (IS), Christos Katsavrias, MSc (CK)

Contribution to international associations:

- IAD: Editor-in-Chief of Annales Geophysicae journal, European Geosciences Union (EGU)
- IAD: Scientific Discipline Representative to SCOSTEP (Scientific Committee on Solar-Terrestrial Physics)
- IAD: Chair of the Next Scientific Program (NSP) Committee of SCOSTEP.
- IAD: Steering Board Member of the Space Weather Working Team, European Space Agency.
- IAD: Full Member of the International Academy of Astronautics (IAA).
- IAD: Member of the International Living With a Star Working Group.

Community service:

MG: Fred L. Scarf Award Committee Member (<https://honors.agu.org/sfg-award-lecture/fred-l-scarf-award/>)

International Research Programs:

- G4G (Geant4-based Particle Simulation Facility in Greece for Future Science Mission Support) project, funded by the European Space Agency (2018-2022)
- VALIRENE (Radiation Belt Model Development and Validation: AP9/AE9/SPM models) project, funded by the European Space Agency (2016-2018)
- HERMES (Hellenic Evolution of Radiation data processing and Modelling of the Environment in Space) project, funded by the European Space Agency (2015-2018)
- EPN2020-RI (Europlanet 2020 Research Infrastructure): European Commission H2020 project (2015-2019)
- SREMD (SREM and REM Data Consolidation) project, funded by the European Space Agency (2015-2018)

Publications:

- Aminalragia-Giamini S, Sandberg I, Papadimitriou C, Daglis IA, and Jiggins P, The virtual enhancements solar proton event radiation (VESPER) model, *J. Space Weather Space Clim.* 8: A06, doi: 10.1051/swsc/2017040, 2018
- Aminalragia-Giamini, S., C. Papadimitriou, I. Sandberg, A. Tsigkanos, P. Jiggins, H. Evans, D. Rodgers and I. A. Daglis, Artificial Intelligence Unfolding for Space Radiation Monitor data *J. Space Weather Space Clim.*, in press, 2018
- Arruda, Luisa, Patricia Goncalves, Ingmar Sandberg, Sigiava Giamini, Ioannis Daglis, Arlindo Marques, Joao Pinto, Adolfo Aguilar, Pedro Marinho, Tiago Sousa, Hugh Evans, Piers Jiggins, Alessandra Menicucci, and Petteri Nieminen, SEP

- Protons in GEO measured with the ESA MultiFunctional Spectrometer, *IEEE Transactions on Nuclear Science*, doi: 10.1109/TNS.2017.2714461, 2017.
- Balasis, G., C. Papadimitriou, I. A. Daglis, and V. Pilipenko, ULF wave power features in the topside ionosphere revealed by Swarm observations, *Geophysical Research Letters*, 42, doi:10.1002/2015GL065424, 2015.
 - Balasis, G., I. A. Daglis, I.R. Mann, C. Papadimitriou, E. Zesta, M. Georgiou, R. Haagmans, and K. Tsinganos, Multi-satellite study of the excitation of Pc3 and Pc4-5 ULF waves and their penetration across the plasmopause during the 2003 Halloween superstorm, *Annales Geophysicae*, 33, 1237-1252, doi:10.5194/angeo-33-1237-2015, 2015.
 - Balasis, G., I.A. Daglis, and I.R. Mann, editors, *Waves, Particles, and Storms in Geospace: A Complex Interplay*, Oxford University Press, 2016
 - Balasis, G., Daglis, I. A., Contoyiannis, Y., Potirakis, S. M., Papadimitriou, C., Melis, N. S., Giannakis, O., Papaioannou, A., Anastasiadis, A., and Kontoes, C., Observation of intermittency-induced critical dynamics in geomagnetic field time series prior to the intense magnetic storms of March, June, and December 2015, *Journal of Geophysical Research: Space Physics*, 123, <https://doi.org/10.1002/2017JA025131>, 2018.
 - De Ridder, K., B. Maiheu, D. Lauwaet, I.A. Daglis, I. Keramitsoglou, K. Kourtidis, P. Manunta, and M. Paganini, Urban Heat Island Intensification during Hot Spells—The Case of Paris during the Summer of 2003, *Urban Science*, 1, 3; doi:10.3390/urbansci1010003, 2016.
 - Dimitrakoudis, S., I. Mann, G. Balasis, C. Papadimitriou, A. Anastasiadis and I. A. Daglis, Accurately specifying storm-time ULF wave radial diffusion in the radiation belts. *Geophysical Research Letters*, 42(14), 5711-5718, doi: 10.1002/2015GRL064707, 2015
 - Ganushkina, N.Y., M. W. Liemohn, S. Dubyagin, I. A. Daglis, I. Dandouras, D. L. De Zeeuw, Y. Ebihara, R. Ilie, R. Katus, M. Kubyshkina, S. E. Milan, S. Ohtani, N. Ostgaard, J. P. Reistad, P. Tenfjord, F. Toffoletto, S. Zaharia, and O. Amariutei, Defining and resolving current systems in geospace, *Annales Geophysicae*, 33, 1369-1402, doi:10.5194/angeo-33-1369-2015, 2015.
 - Georgiou, M., I. A. Daglis, E. Zesta, G. Balasis, I.R. Mann, Ch., Katsavrias, and K. Tsinganos, Association of radiation belt electron enhancements with earthward penetration of Pc5 ULF waves: A case study of intense 2001 magnetic storms, *Annales Geophysicae*, 33, 1431-1442, doi:10.5194/angeo-33-1431-2015, 2015.
 - Georgoulis M, Papaioannou A, Sandberg I, Anastasiadis A, Daglis I, Rodríguez-Gasén R, Aran A, Sanahuja B, and Nieminen P, Analysis and interpretation of inner heliospheric SEP events with the ESA Standard Radiation Environment Monitor (SREM) onboard the INTEGRAL and Rosetta Missions, *J. Space Weather Space Clim.* 8, A40, <https://doi.org/10.1051/swsc/2018027>, 2018
 - Katsavrias, C., I. A. Daglis, W. Li, S. Dimitrakoudis, M. Georgiou, D. L. Turner, and C. Papadimitriou, Combined effects of concurrent Pc5 and chorus waves on relativistic electron dynamics, *Annales Geophysicae*, 33, 1173-1181, doi:10.5194/angeo-33-1173-2015, 2015
 - Katsavrias, C., I. A. Daglis, D. L. Turner, I. Sandberg, C. Papadimitriou, M. Georgiou, and G. Balasis, Nonstorm loss of relativistic electrons in the outer radiation belt, *Geophysical Research Letters*, 42, 10,521–10,530, doi:10.1002/2015GL066773, 2015.
 - Katsavrias Ch., A. Hillaris and P. Preka-Papadema, A Wavelet Based Approach to Solar Terrestrial Coupling, *Advances in Space Research*, Vol. 57, p. 2234-2244, DOI: 10.1016/j.asr.2016.03.001, 2016
 - Maget, V., A. Sicard-Piet, S. Bourdarie, D. Lazaro, D. L. Turner, I. A. Daglis, and I. Sandberg, Improved outer boundary conditions for outer radiation belt data

- assimilation using THEMIS-SST data and the Salamambo-EnKF code, *Journal of Geophysical Research - Space Physics*, 120, doi:10.1002/2015JA021001, 2015.
- Mann, I.R., L. G. Ozeke, K. R. Murphy, S. G. Claudepierre, D. L. Turner, D. N. Baker, I. J. Rae, A. Kale, D. K. Milling, A. J. Boyd, H. E. Spence, G. D. Reeves, H. J. Singer, S. Dimitrakoudis, I. A. Daglis, and F. Honary, Explaining the dynamics of the ultra-relativistic third Van Allen radiation belt, *Nature Physics*, doi: 10.1038/NPHYS, 2016.
 - Mann, I.R., L. G. Ozeke, S. K. Morley, K. R. Murphy, S. G. Claudepierre, D. L. Turner, D. N. Baker, I. J. Rae, A. Kale, D. K. Milling, A. J. Boyd, H. E. Spence, H. J. Singer, S. Dimitrakoudis, I. A. Daglis, and F. Honary, The dynamics of Van Allen belts revisited – reply to the comment of Shprits et al., *Nature Physics*, vol. 14, pp. 102-104, February 2018.
 - Patsourakos, S., MK Georgoulis, A Vourlidas, A Nindos, T Sarris, G Anagnostopoulos, A Anastasiadis, G Chintzoglou, IA Daglis, C Gontikakis, N Hatzigeorgiou, AC Iliopoulos, C Katsavrias, A Kouloumvakos, K Moraitis, T Nieves-Chinchilla, G Pavlos, D Sarafopoulos, P Syntelis, C Tsironis, K Tziotziou, II Vogiatzis, G Balasis, M Georgiou, LP Karakatsanis, OE Malandraki, C Papadimitriou, D Odstrcil, EG Pavlos, O Podlachikova, I Sandberg, DL Turner, MN Xenakis, E Sarris, K Tsinganos, L Vlahos, The major geoeffective solar eruptions of 2012 March 7: comprehensive Sun-to-Earth analysis, *The Astrophysical Journal*, 817 (1), 14, doi:10.3847/0004-637X/817/1/14, 2016.
 - Reeves, G.D., and I.A. Daglis, Geospace magnetic storms and the Van Allen radiation belts, in *Waves, Particles & Storms in Geospace*, edited by G. Balasis, I.A. Daglis and I.R. Mann, pp. 51-79, Oxford University Press, 2016.
 - Rodriguez, J.V., I. Sandberg, R.A. Mewaldt, I.A. Daglis, and P. Jiggins, Validation of the effect of cross-calibrated GOES solar proton effective energies on derived integral fluxes by comparison with STEREO observations, *Space Weather*, 15, doi:10.1002/2016SW001533, 2017.
 - Tsironis C., A. Anastasiadis, Ch. Katsavrias and I. A. Daglis, Modeling of Ion Dynamics in the Inner Geospace during Enhanced Magnetospheric Activity, *Annales Geophysicae*, Vol. 34, p. 171-185, DOI: 10.5194/angeo-34-171-2016, 2016

Invited talks at International Conferences:

- I.A. Daglis: “Radiation belts and ring current during geospace magnetic storms”, 2015 International Workshop on the Interrelationship between Plasma Experiments in the Laboratory and in Space (IPELS2015), Pitlochry (Scotland), United Kingdom, 23-28 August 2015
- I.A. Daglis: “Near-Earth particle environment relevant to space weather – A tutorial”, Science for Space Weather Workshop, Calangute, Goa, India, 24-29 January 2016.
- I.A. Daglis: “Major results of the MAARBLE project”, European Geosciences Union General Assembly 2016, Vienna, Austria, 17-22 April 2016.
- I.A. Daglis: “The MAARBLE Project: Investigating the properties of ELM waves and their influence on the dynamic evolution of the Van Allen belts”, 4th Cluster-THEMIS Workshop, Palm Springs, California, USA, 7-10 November 2016
- I.A. Daglis: “Space activities in Greece”, Annual Meeting of the European Space Sciences Committee, Athens, Greece, 1 June 2017.
- I.A. Daglis: “Storm-substorm relation and its connection to geospace energetic particles”, 20th anniversary symposium of Rikubetsu Observatory “From Space to the Earth”, Rikubetsu (Hokkaido), Japan, 8-9 November 2017

- I.A. Daglis: “Electromagnetic waves and relativistic electrons in geospace: an effective bond”, Isradynamics 2018 - Dynamical Processes in Space Plasmas, Ein Bokek, Israel, 22-29 April 2018
- I.A. Daglis: “Dynamics of energetic particles in the inner magnetosphere and role of wave-particle interactions”, AOGS (Asia Oceania Geosciences Society) 15th Annual Meeting, Honolulu (Hawaii), USA, 3-8 June 2018

National Observatory of Athens

Dr Anastasios Anastasiadis and Dr Athanasios Papaioannou

Infrastructures:

FORSPEF Tool: Web-based open access tool (24/7) that provides forecasting of solar eruptive events, such as solar flares with a projection to coronal mass ejections (CMEs) (occurrence and velocity) and the likelihood of occurrence of a solar energetic proton (SEP) event. The tool also provides nowcasting of SEP events based on actual solar flare and CME near real-time alerts, as well as SEP characteristics (peak flux, fluence, rise time, duration) per parent solar event [ESA Contract No. 4000109641/13/NL/AK] (<http://tromos.space.noa.gr/forspef/>)

ASPECS Tool: A novel tool that aims at advancing the technology development for the forecasting of solar energetic particles and flares, with the implementation of a web based advanced warning system able to provide outputs tailored to the needs of spacecraft and launch operators, as well as aviators [ESA Contract No. 4000120480/17/NL/LF/hh] (<http://tromos.space.noa.gr/aspecs/>)

Contribution to International Associations:

Editorial Boards

- International Review of Physics
- Entropy

Guest Editor of:

- A Topical Issue on "*Measurement, Specification and Forecasting of the Solar Energetic Particle (SEP) Environment*", (eds.) P. Jiggins & A. Mishev, J. Space Weather & Space Climate, 2017

Liaison Officer for:

- News, Media, Education: Division of Solar-Terrestrial (ST) Sciences (European Geosciences Union - EGU), 2014 - present

Invited talks in International Conferences:

- A. Papaioannou, A. Anastasiadis, I. Sandberg, A. Kouloumvakos, M. K. Georgoulis, K. Tziotziou, G. Tsiropoula, P. Jiggins, A. Hilgers: “Solar Flares, Coronal Mass Ejections and Solar Energetic Particle Event Characteristics”, ESWW13 Session 4 /

Flares, coronal mass ejections and solar energetic particles: Space Weather Impact, Oostende, Belgium, 15/11/2016

- A. Papaioannou: Linking Solar Eruptions to Space Radiation Storms: Solar Energetic Particle Events and Flares foretold", SEPRAD Expert-Workshop, Forecasting of Solar Energetic Particle Radiation Effects, Seibersdorf Laboratories, Vienna, Austria, 18/09/2017
- A. Papaioannou: Neutron Monitors and the Heliosphere: past, present and future, Seminar at the Physics Department, University of Athens, Athens, Greece, 19/10/2017
- A. Papaioannou: Solar Eruptions and their Heliospheric Imprint, Seminar at the National Observatory of Athens, Pedeli, Greece, 03/11/2017
- A. Papaioannou: The dynamic influence of the Sun in the inner heliosphere, Institut de Ciencies del Cosmos, University of Barcelona, Barcelona, Spain, 16/07/2018

Publications:

- Belov, A. Abunin, M. Abunina, E. Eroshenko, V. Oleneva, V. Yanke, A. Papaioannou, H. Mavromichalaki : 'Galactic Cosmic Ray Density Variations in Magnetic Clouds', *Solar Phys.*, DOI:10.1007/s11207-015-0678-z, 2015
- I. Kontogiannis, A. Belehaki, G. Tsiropoula, I. Tsagouri, A. Anastasiadis and A. Papaioannou, 2016. Building a new space weather facility at the National Observatory of Athens. *Advances in Space Research*, 57(1), 418-430, doi:10.1016/j.asr.2015.10.028.
- S. Patsourakos, M. K. Georgoulis, A. Vourlidas, A. Nindos, T. Sarris, G. Anagnostopoulos, A. Anastasiadis, G. Chintzoglou, et al. 2016. The Major Geoeffective Solar Eruptions of 2012 March 7: Comprehensive Sun-to-Earth Analysis. *Astrophysical Journal*, 817:14 (21pp), doi:10.3847/0004-637X/817/1/14
- A. Kouloumvakos, S. Patsourakos, A. Nintos, A. Vourlidas, A. Anastasiadis, A. Hillaris and I. Sandberg, 2016. Multi-viewpoint observations of a widely-distributed solar energetic particle event: the role of EUV waves and White Light shock signatures. *Astrophysical Journal*, 821:31 (15pp), doi:10.3847/0004-637X/821/1/31
- A. Papaioannou, I. Sandberg, A. Anastasiadis, A. Kouloumvakos, M. K. Georgoulis, K. Tziotziou, G. Tsiropoula, P. Jiggins and A. Hilgers, 2016. Solar Flares, Coronal Mass Ejections and Solar Energetic Particle Event Characteristics. *Journal of Space Weather and Space Climate*, 6, A42, doi:10.1051/swsc/2016035.
- D. Lario, R.-Y. Kwon, A. Vourlidas, N.E. Raouafi, D.K. Haggerty, G.C. Ho, B.J. Anderson, A. Papaioannou, R. Gomez-Herrero, N. Dresing, P. Riley: 'Longitudinal Properties of a Widespread Solar Energetic Particle Event on 2014 February 25: Evolution of the Associated CME Shock', *Astrophys. J.*, 10.3847/0004-637X/819/1/72, 2016\
- L. Vlahos, Th. Pisokas, H. Isliker, V. Tsiolis and A. Anastasiadis, 2016. Particle Acceleration and Heating by Turbulent Reconnection. *Astrophysical Journal Letters*, 827:L3 (5pp), doi:10.3847/2041-8205/827/1/L3.
- Th. Pisokas, L. Vlahos, H. Isliker, V. Tsiolis and A. Anastasiadis, 2017. Stochastic Fermi Energization of Coronal Plasma during Explosive Magnetic Energy Release. *Astrophysical Journal*, 835: 214 (12pp), doi:10.3847/1538-4357/835/2/214
- H.Isliker, Th. Pisokas, L. Vlahos and A. Anastasiadis, 2017. Particle Acceleration and Fractional Transport in Turbulent Reconnection. *Astrophysical Journal*, 849:35 (13pp), doi:10.3847/1538-4357/aa8ee8
- A. Anastasiadis, A. Papaioannou, I. Sandberg, M. K. Georgoulis, K. Tziotziou, A. Kouloumvakos and P. Jiggins, 2017. Predicting Flares and Solar Energetic Particle

Events: the FORSPEF Tool. *Solar Physics*, 292(9):134 (21pp), doi: 10.1007/s11207-017-1163-7

- M. Paasilta, O. Raukunen, R. Vainio, E. Valtonen, A. Papaioannou, R. Siipola, E. Riihonen, M. Dierckxsens, N. Crosby, O. Malandraki, B. Heber, K.- L. Klein: 'Catalogue of > 55 MeV Solar Proton Events Extending Through Solar Cycle 23 and 24', *J. Space Weather Space Clim.*, 7, A14, 2017
- D. Lario, R.-Y. Kwon, I.G. Richardson, N.E. Raouafi, B.J. Thompson, T.T. von Roseninge, M.L. Mays, P.A. Mäkelä, H. Xie, H.M. Bain, M. Zhang, L. Zhao, H.V. Cane, A. Papaioannou, N. Thakur, P. Riley: 'The Solar Energetic Particle Event of 2010 August 14: Connectivity with the Solar Source Inferred from Multiple Spacecraft Observations and Modeling', *Astrophys. J.*, DOI: 10.3847/1538-4357/aa63e4, 2017
- G. Balasis, I.A. Daglis, Y. Contoyiannis, S.M. Potirakis, C. Papadimitriou, N.S. Melis, O. Giannakis, A. Papaioannou, A. Anastasiadis and C. Kontoes, 2018. Observation of intermittency-induced critical dynamics in geomagnetic field time series prior to the intense magnetic storms of March, June and December 2015, *Journal of Geophysical Research*, 123, 4594-4613, doi: 10.1002/2017JA025131.
- A. Papaioannou, A. Anastasiadis, I. Sandberg and P. Jiggins, 2018. Nowcasting of Solar Energetic Particle Events using near real-time Coronal Mass Ejection characteristics in the framework of the FORSPEF tool. *Journal of Space Weather and Space Climate*, 8, A37, doi:10.1051/swsc/2018024.
- A. Papaioannou, A. Anastasiadis, A. Kouloumvakos, M. Paasilta, R. Vainio, E. Valtonen, A. Belov, E. Eroshenko, M. Abunina and A. Abunin, 2018. Nowcasting Solar Energetic Particle (SEP) Events using Principal Components Analysis (PCA). *Solar Physics*, 293:100, doi: 10.1007/s11207-018-1320-7
- M. K. Georgoulis, A. Papaioannou, I. Sandberg, A. Anastasiadis, I. A. Daglis, R. Rodriguez-Gasen, A. Aran, B. Sanahuja and P. Nieminen, 2018. Analysis and Interpretation of Inner-Heliospheric SEP Events with the ESA Standard Radiation Environment Monitor (SREM) Onboard the INTEGRAL and Rosetta Missions. *Journal of Space Weather and Space Climate*, 8, A40, doi:10.1051/swsc/2018027
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- A. Belov, E. Eroshenko V. Yanke, V. Oleneva, A. Abunin, M. Abunina, A. Papaioannou , H. Mavromichalaki: The Global Survey Method Applied to Ground Level Cosmic Ray Measurements, *Solar Physics*, 293, 68, DOI: 10.1007/s11207-018-1277-6, 2018
- M. Paasilta, A. Papaioannou , Nina Dresing, Rami Vainio, Eino Valtonen, Bernd Heber: Catalogue of > 55 MeV Wide-longitude Solar Proton Events Observed by SOHO, ACE, and the STEREOs at ~1 AU during 2009-2016, *Solar Physics*, 293, 70, DOI:10.1007/s11207-018-1284-7, 2018

International Research Projects:

- HEROIC project: High Energy Solar Particle Events Scientific Analysis, International Space Science Institute (ISSI), Bern, Switzerland International Team 441/2018, 2018-2019
- ASPECS project: Advanced Solar Particle Events Casting System, European Space Agency, 2017- 2019.

- Multivariate Statistical Analysis applied to Solar Energetic Particle Events Forecasting, State Scholarship Foundation, IKY, 2017-2018
- AREMBES project: Athena Radiation Environment Models and X-Ray Background Effects Simulators, European Space Agency, 2016-2018.
- HESPERIA Project: High Energy Solar Particle Events Forecasting and Analysis, H2020 under PROTEC-1-2014: Space Weather, Project Ref. 637324, 2015-2017

National Observatory of Athens

Dr Georgios Balasis

Contribution to International Associations:

- Secretary, Earth Magnetism and Rock Physics (EMRP) Division, European Geosciences Union (EGU).
- National Delegate of Greece to the Programme Board of European Space Agency (ESA) Space Situational Awareness (SSA) Programme.
- Scientific Committee. Fourth Swarm Science Meeting & Geodetic Missions Workshop, Banff, Alberta, Canada, 20–24 March 2017.
- Scientific Committee. ESA Living Planet Symposium 2016, Prague, Czech Republic, 9–13 May 2016.
- Convener/Co-convener of Conference Session (last ones): European Geosciences Union (EGU) General Assembly [2015-2018], European Space Weather Week [2017], International Union of Geodesy and Geophysics (IUGG) [2015]
- Editor of European Geosciences Union (EGU) journal *Annales Geophysicae* in Magnetosphere and Space Plasma Physics section.
- Review Editor, *Frontiers in Physics*; *Frontiers in Astronomy and Space Sciences*.
- Guest Editor, *Journal of Space Weather and Space Climate*.

Publications:

- Balasis, G., I. A. Daglis, and I. R. Mann (editors), “Waves, Particles, and Storms in Geospace”, Oxford University Press, pp. 448, ISBN: 9780198705246, DOI:10.1093/acprof:oso/9780198705246.001.0001, 2016.
- Balasis, G., C. Papadimitriou, E. Zesta, and V. Pilipenko (2016), Monitoring ULF Waves from Low Earth Orbit Satellites, in: “Waves, Particles, and Storms in Geospace”, G. Balasis, I. A. Daglis, and I. R. Mann (eds.), 148–169, Oxford University Press, DOI:10.1093/acprof:oso/9780198705246.001.0001.
- Donner, R. V., V. Stolbova, G. Balasis, J. F. Donges, M. Georgiou, S. M. Potirakis, and J. Kurths, Temporal organization of magnetospheric fluctuations unveiled by recurrence patterns in the Dst index, *Chaos*, 28, 085716, doi: 10.1063/1.5024792.
- Sergis, N., Achilleos, N., Guio, P., Arridge, C. S., Sorba, A. M., Roussos, E., et al. (2018), Mapping Saturn’s nightside plasma sheet using Cassini’s proximal orbits, *Geophys. Res. Lett.*, 45, 6798–6804, doi:10.1029/2018GL078141.
- Balasis, G., Daglis, I. A., Contoyiannis, Y., Potirakis, S. M., Papadimitriou, C., Melis, N. S., et al. (2018), Observation of intermittency-induced critical dynamics in geomagnetic field time series prior to the intense magnetic storms of March, June, and December 2015, *J. Geophys. Res.: Space Physics*, 123, 4594–4613, doi:10.1002/2017JA025131.

- Papadimitriou, C., G. Balasis, I. A. Daglis, and O. Giannakis (2018), An initial ULF wave index derived from two years of Swarm observations, *Ann. Geophys.*, 36, 287–299, <https://doi.org/10.5194/angeo-36-287-2018>.
- Pakhotin, I. P., Mann, I. R., Lysak, R. L., Knudsen, D. J., Gjerloev, J. W., Rae, I. J.,...Balasis, G. (2018), Diagnosing the role of Alfvén waves in magnetosphere-ionosphere coupling: Swarm observations of large amplitude nonstationary magnetic perturbations during an interval of northward IMF, *J. of Geophys. Res.: Space Physics*, 123, 326–340, doi:10.1002/2017JA024713.
- De Santis, A., G. Balasis, F.J. Pavón-Carrasco, G. Cianchini, and M. Manda (2017), Potential earthquake precursory pattern from space: The 2015 Nepal event as seen by magnetic Swarm satellites, *Earth and Planetary Science Letters*, 461, 119-126, doi:10.1016/j.epsl.2016.12.037.
- Potirakis, S. M., Y. Contoyiannis, N. S. Melis, J. Kopanas, G. Antonopoulos, G. Balasis, C. Kontoes, C. Nomicos, and K. Eftaxias, Recent seismic activity at Cephalonia island (Greece): a study through candidate electromagnetic pre-cursors in terms of nonlinear dynamics, *Nonlin. Proc. Geophys.*, 23, 223–240, doi:10.5194/npg-23-223-2016, 2016.
- Balasis, G., S. M. Potirakis, and M. Manda (2016), Investigating Dynamical Complexity of Geomagnetic Jerks using Various Entropy Measures, *Front. Earth Sci.*, 4:71, doi:10.3389/feart.2016.00071.
- Balasis, G., Book Review: *Galactic Encounters*, *Front. Astron. Space Sci.*, 3:18, doi:10.3389/fspas.2016.00018, 2016.
- Patsourakos, S., et al., The Major Geoeffective Solar Eruptions of 7 March 2012: Comprehensive Sun-to-Earth Analysis, *Astrophysical Journal*, 817:14 (21pp), doi:10.3847/0004-637X/817/1/14, 2016.
- Katsavrias, Ch., I. A. Daglis, D. L. Turner, I. Sandberg, C. Papadimitriou, M. Georgiou, and G. Balasis (2015), Nonstorm loss of relativistic electrons in the outer radiation belt, *Geophys. Res. Lett.*, 42, 10,521–10,530, doi:10.1002/2015GL066773.
- Georgiou, M., I. A. Daglis, E. Zesta, G. Balasis, C. Katsavrias, and K. Tsinganos, Association of radiation belt electron enhancements with earthward penetration of Pc5 waves: A case study of intense 2001 magnetic storms, *Ann. Geophys.*, 33, 1431–1442, doi:10.5194/angeo-33-1431-2015, 2015.
- Balasis, G., I. A. Daglis, I. R. Mann, C. Papadimitriou, M. Georgiou, E. Zesta, and R. Haagmans, Multi-satellite study of the excitation of Pc3 and Pc4-5 ULF waves and their penetration across the plasmapause during the 2003 Hal-loween superstorm, *Ann. Geophys.*, 33, 1237–1252, doi:10.5194/angeo-33-1237-2015, 2015.
- Balasis, G., C. Papadimitriou, I. A. Daglis, and V. Pilipenko (2015), ULF wave power features in the topside ionosphere revealed by Swarm observations, *Geophys. Res. Lett.*, 42, 6922–6930, doi:10.1002/2015GL065424.
- Dimitrakoudis, S., I. R. Mann, G. Balasis, C. Papadimitriou, A. Anastasiadis, and I. A. Daglis (2015), Accurately specifying storm-time ULF wave radial diffusion in the radiation belts, *Geophys. Res. Lett.*, 42, 5711–5718, doi:10.1002/2015GL064707.
- De Santis, A., et al. Geospace perturbations induced by the Earth: The state of the art and future trends. *J. Phys. Chem. Earth*, 85–86 (2015), 17–33, doi:10.1016/j.pce.2015.05.004.
- Donner, R. V., Potirakis, S. M., Balasis, G., Eftaxias, K., and J. Kurths, Temporal correlation patterns in pre-seismic electromagnetic emissions reveal distinct complexity profiles prior to major earthquakes. *J. Phys. Chem. Earth* 85–86 (2015), 44–55, doi:10.1016/j.pce.2015.03.008.

Invited talks:

- Invited Talk, Lorentz Workshop: “Space Weather: A Multi-Disciplinary Approach”, Leiden, Netherlands, 25–29 September 2017.

- Keynote Lecture, 13th European Space Weather Week, Ostend, Belgium, 14–18 November 2016.

International Research Projects:

- “Swarm Investigation of the Role of High-Frequency (0.1-5 Hz) ULF Waves in Magnetosphere-Ionosphere Coupling”, Coordinator: University of Alberta, Canada, Funding: European Space Agency, 19.09.2015–23.10.2016.
- SAFE: Swarm for Earthquake Study, Coordinator: Istituto Nazionale di Geofisica e Vulcanologia (INGV), Italy, Funding: European Space Agency, 15.01.2016–15.12.2016.

National Observatory of Athens

Dr Anna Belehaki and the Ionospheric Group of IAASARS

Infrastructures:

The Ionospheric Group of IAASARS/NOA operates the following facilities:

- *The Athens Digisonde: A research infrastructure for remote sensing of the Earth's Ionosphere is operating in the National Observatory of Athens since September 2000. The ionospheric station is upgraded to a Digital Portable Sounder 4D with an 128 chip transmitter allowing operation in bi-static link with receivers and transmitters having the same operational capabilities. The station can operate in many different modes: 1) Scanning ionogram, 2) Drift ionogram 3) Fixed Frequency ionogram 4) Oblique ionogram 5) Digisonde-to-Digisonde operations. All data are processed in real-time and the results are available in the main web site of the Ionospheric Group of IAASARS/NOA (<http://www.iono.noa.gr>), are also transmitted to the WDC-Chilton and to the Global Ionospheric Radio Observatory of UMASS (GIRO).*
- DIAS system: The European Digital Upper Atmosphere Server (DIAS) is the European provider for alerts, nowcasts and forecasts for ionospheric and thermospheric conditions. The service is based on data from 10 European Digisondes (Athens, Rome, Ebre, Arenosillo, Chilton, Juliusruh, Pruhonice, Moscow, Dourbes, Tromso), data from ground-based GNSS receivers and solar wind data from the Lagrange 1 vantage point. The DIAS portal is accessible at <http://dias.space.noa.gr>.
- The European Ionosonde Service (EIS): this service provides ionospheric services to fulfill the requirements of the Space Situational Awareness Programme of the European Space Agency (ESA). The EIS is a federated service and provides ionospheric characteristics mostly based on DIAS products, adapted to cover the whole European region, including Scandinavia.
- Net-TIDE database: it has been developed in the framework of the NATO SPS project “Pilot network for the identification of travelling ionospheric disturbances” and collects recording from the Digisonde-to-Digisonde oblique skymap drift data and the processed values which specify the TID characteristics such as Doppler shift, azimuth, elevation and group path. The visualization of these results is provided in <http://tid.space.noa.gr> and it is updated every 5 minutes.
- TechTIDE open access software and data: This is the repository of the TechTIDE project (<http://www.tech-tide.eu>). It is gradually populated with the list of TID active periods identified with the TechTIDE methods and with open access codes for the identification of TIDs with a observations from Digisondes, Continuous Doppler Sounding, and GNSS data.

Contribution to International Associations, Journals, Committees

Anna Belehaki is:

- Editor in Chief for the Journal of Space Weather and Space Climate (Publisher: EDP Science, IF=2.5)
- Member of the Space Weather Birkeland Medal Committee of the Norwegian Academy of Science
- Member of the Space Weather Working Team Board of the European Space Agency
- Member of the Programme Committee of the European Space Weather Week

Publications:

- The ESPAS e-infrastructure: Access to data from near-Earth space, Eds. Anna Belehaki, Mike Hapgood and Juergen Watermann, DOI: 10.1051/978-2-7598-1949-2, ISBN: 978-2-7598-1949-2 (<http://www.edp-open.org/images/stories/books/fulldl/ESPAS.pdf>)
- Krishnendu Sekhar P., H. Haralambous, C. Oikonomou, A. Paul, A. Belehaki, I. Tsagouri, D. Kouba, D. Buresova (2018), Multi-station investigation of spread F over Europe during low to high solar activity, J. Space Weather Space Clim. 8 A27, DOI: 10.1051/swsc/2018006.
- Reinisch, B., I. Galkin, A. Belehaki, V. Paznukhov, X. Huang, F. Altadill, D. Buresova, J. Mielich, T. Verhulst, S. Stankov, E. Blanch, D. Kouba, R. Hamel, A. Kozlov, I. Tsagouri, A. Mouzakis, M. Messerotti, M. Parkinson and M. Ischii, Pilot ionosonde network for identification of traveling ionospheric disturbances (2018), Radio Science, <https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2017RS006263>.
- Marinov, P., I. Kutiev, A. Belehaki, I. Tsagouri, 3D electron density specification to support LEO and MEO satellite applications (2017), Journal of Atmospheric and Solar-Terrestrial Physics, <https://doi.org/10.1016/j.jastp.2017.10.003>.
- Verhulst, T., D. Altadill, J. Mielich, B. Reinisch, I. Galkin, A. Mouzakis, A. Belehaki, D. Burešová, S. Stankov, E. Blanch, D. Kouba, Vertical and oblique HF sounding with a network of synchronised ionosondes (2017), Advances in Space Research, 60, 8, 1644-1656, <https://doi.org/10.1016/j.asr.2017.06.033>.
- Lilensten, J., A. Belehaki, J. Watermann, J. Janssens and A. Henri, The Journal of Space Weather and Space Climate – the first six years: status and evaluation of published papers and policies, J. Space Weather Space Clim., 7 (2017) E1, DOI: <https://doi.org/10.1051/swsc/2017002>
- Belehaki, A., I. Kutiev, P. Marinov, I. Tsagouri, K. Koutroumbas, P. Elias (2017) Ionospheric electron density perturbations during the 7–10 March 2012 geomagnetic storm period, Advances in Space Research, ISSN 0273-1177, <http://dx.doi.org/10.1016/j.asr.2016.11.031>.
- Kutiev, I., P. Marinov, A. Belehaki (2016) Real time 3-D electron density reconstruction over Europe by using TaD profiler, Radio Science, 51, 7, 1176-1187, DOI: 10.1002/2015RS005932
- Ritschel, B., Borchert, F., Kneitschel, G., Neher G., Schildbach, S., Iyemori T., Koyama Y., Yatagai A., Hori, T., Hapgood M., Belehaki A., Galkin I., King T. (2016) Experiments using Semantic Web Technologies to connect IUGONET, ESPAS and GFZ ISDC data portals, Earth Planets Space, 68: 181. doi:10.1186/s40623-016-0542-x
- Zolesi, B., C. Bianchi, A. Meloni, J. A. Baskaradas, A. Belehaki, D. Altadill, and E. Dalle Mese (2016), “SWING”: A European project for a new application of an ionospheric network, Radio Sci., 51, 421–428, doi:10.1002/2016RS006037.
- Belehaki, A., S. James, M. Hapgood, S. Ventouras, I. Galkin, A. Lembesis, I. Tsagouri, A. Charisi, L. Spogli, J. Berdermann, I. Häggström (2016), The ESPAS e-Infrastructure: Access to Data From Near-Earth Space, Advances in Space Research, Available online 17 June 2016, ISSN 0273-1177, <http://dx.doi.org/10.1016/j.asr.2016.06.014>.

- Kontogiannis, I., A. Belehaki, G. Tsiropoula, I. Tsagouri, A. Anastasiadis, A. Papaioannou (2016), Building a new space weather facility at the National Observatory of Athens, *Advances in Space Research*, <http://dx.doi.org/10.1016/j.asr.2015.10.028>.
- Marinov, P., I. Kutiev, A. Belehaki, and I. Tsagouri, Modeling the plasmasphere to topside ionosphere scale height ratio. *J. Space Weather Space Clim.*, 5, A27 (2015) DOI: 10.1051/swsc/2015028.
- Belehaki A., I. Kutiev, I. Tsagouri and P. Marinov, Characteristics of large scale travelling ionospheric disturbances exploiting ground-based ionograms, GPS-TEC and 3D electron density distribution maps, *Proc. 14th Int. Ionospheric Effects Symposium (IES-2015)*, Alexandria, Virginia, 12-14 May 2015.
- Belehaki A., B. Reinisch, I. Galkin, D. Altadill, D. Buresova, M. Francis, J. Mielich, V. Paznukhov, S. Stankov Pilot network for identification of travelling ionospheric disturbances, *Proc. 14th Int. Ionospheric Effects Symposium (IES-2015)*, Alexandria, Virginia, 12-14 May 2015.
- Belehaki A., I. Tsagouri, I. Kutiev, P. Marinov, B. Zolesi, M. Pietrella, K. Themelis, P. Elias, K. Tziotziou, The European Ionosonde Service: nowcasting and forecasting ionospheric conditions over Europe for the ESA Space Situational Awareness services, *J. Space Weather Space Clim.* 5 A25 (2015), DOI: 10.1051/swsc/2015026
- Tsagouri I., A. Belehaki, Ionospheric forecasts for the European region for space weather applications, *J. Space Weather Space Clim.* 5 A9 (2015), DOI: 10.1051/swsc/2015010

Invited talks to international Conferences:

- Belehaki, A., "Ionospheric specification services from the DIAS ionosonde network", *URSI AT-RASC Gran Canaria*, 18-22 May 2015
- Belehaki, A., "Identification of travelling ionospheric disturbances and perspectives for the development of warning services", Keynote at the 14th European Space Weather Week, Oostende, Belgium, 14 November 2017, Oostende, Belgium
- Belehaki, A., "Detection of travelling ionospheric disturbances in TechTIDE EC H2020 project and perspectives for the development of mitigation strategies", *EGU General Assembly*, Vienna, 8-13 April 2018
- Belehaki, A., "Identification of travelling ionospheric disturbances with HF and GNSS experiments", *URSI AT-RASC, Gran Canaria*, 28 May – 1 June 2018

International Research Projects:

- "Warning and Mitigation of Travelling Ionospheric Disturbances Effects", European Commission Horizon 2020 [TechTIDE Project](#) (2017 - 2020), Total Budget 1.6 Meuro, Project Coordinator: Dr Anna Belehaki
- "ESA SSA Expert Center Coordination, Phase 3" 2018 – 2019, Consortium built around the Ionospheric Expert Center Groups, coordinated by DLR, Total budget: 4.5 Meuro
- " Pilot Network for the Identification of Travelling Ionospheric Disturbances " (SPS 984894) NATO Science for Peace and Security multi-year project, 2014 - 2017, <https://sites.google.com/site/spsionosphere/>, Total budget: 400 k euro, Project Director: Dr Anna Belehaki
- "ESA SSA Expert Center Coordination" 2015 – 2017, Consortium built around all ESA member states coordinated by Airbus, Total budget: 4 M euro
- " Identification and tracking of LSTID exploiting 3D electron density distributions ", USAF Grant, 2014 - 2016, Total budget: 130 k USD, Principal Investigator: Anna Belehaki

- “Near-Earth space data infrastructure for e-science” (ESPAS), European Commission FP7, 2011-2015 (<http://www.espas-fp7.eu>), Total Budget: 5 M euro, Project Coordinator: Prof. Mike Hapgood, Scientific Manager: Dr Anna Belehaki.

Democritus University of Thrace

Theodoros Sarris, Associate Professor

Publications:

- Konstantinidis, K. and T. Sarris, Calculations of the integral invariant coordinates I and L in the magnetosphere and mapping of the regions where I is conserved, using a particle tracer (ptr3D v2.0), LANL*, SPENVIS, and IRBEM, *Geosci. Model Dev.*, 8, 1–9, 2015, www.geosci-model-dev.net/8/1/2015/, doi:10.5194/gmd-8-1-2015.
- Patsourakos, S., M. K. Georgoulis, A. Vourlidis, A. Nindos, T. Sarris, G. Anagnostopoulos, A. Anastasiadis, et al., The Major Geoeffective Solar Eruptions of 2012 March 7: Comprehensive Sun-to-Earth Analysis, *The Astrophysical Journal*, 817:14 (21pp), 2016 January 20, doi: 10.3847/0004-637X/817/1/14
- A. A. Petrukovich, T. Inamori, J. Balaz, K. Kudela, V. A., Gladyshev, E.T. Sarris, Oscillations of energetic ions near the Earth's bow shock, *J. Geophys. Res.*, 2015JA021077R, Jan 2015.
- Scott Elkington and Theodore Sarris, The role of Pc5 waves in radiation belt dynamics: Current understanding and open questions, in: *Waves, Particles and Storms in Geospace: A Complex Interplay*, Oxford University Press, 1 Oct. 2016, ISBN-10: 0198705247, ISBN-13: 978-0198705246
- Liu, W., W. Tu, X. Li, T. Sarris, Y. Khotyaintsev, H. Fu, H. Zhang, and Q. Shi (2016), On the calculation of electric diffusion coefficient of radiation belt electrons with in situ electric field measurements by THEMIS, *Geophys. Res. Lett.*, 43, 1023–1030, doi:10.1002/2015GL067398.
- Sarris, T. E. and Li, X.: Calculating ultra-low-frequency wave power of the compressional magnetic field vs. L and time: multi-spacecraft analysis using the Van Allen probes, THEMIS and GOES, *Ann. Geophys.*, 34, 565-571, doi:10.5194/angeo-34-565-2016, 2016.
- Califf, S., X. Li, H. Zhao, A. Kellerman, T. E. Sarris, A. Jaynes, and D. M. Malaspina (2017), The role of the convection electric field in filling the slot region between the inner and outer radiation belts, *J. Geophys. Res. Space Physics*, 122, 2051–2068, doi:10.1002/2016JA023657.
- Sarris, Theodore and Li, Xinlin (2017), Geomagnetic activity and local time dependence of the distribution of ultra low-frequency wave power in azimuthal wavenumbers, *m*, *Ann. Geophys.*, 35, 629–638, 2017, doi:10.5194/angeo-35-629-2017
- Sarris, T. E., X. Li, M. Temerin, H. Zhao, S. Califf, W. Liu, and R. Ergun (2017), On the relationship between electron flux oscillations and ULF wave-driven radial transport, *J. Geophys. Res. Space Physics*, 122, doi:10.1002/2016JA023741.
- Zhang, D., Liu, W., Li, X., Sarris, T., Xiao, C., & Wygant, J. R. (2018). Observations of impulsive electric fields induced by interplanetary shock. *Geophysical Research Letters*, 45. <https://doi.org/10.1029/2018GL078809>

National and Kapodistrian University of Athens, Department of Physics

Panagiota Preka-Papadema, Assistant Professor, and the ARTEMIS team

Infrastructures:

The Solar Radiospectrograph ARTEMIS-Jean Luis Steinberg (ARTEMIS-IV)

The Solar Radiospectrograph ARTEMIS-IV of the University of Athens is in operation at the Thermopylae Satellite Communication Station since 1996.

The observations extend from the base of the Solar Corona (650 MHz) to about 2 Solar Radii (20 MHz) with time resolution 1/10-1/100s. The recordings in the form of dynamic spectra, measure radio flux as a function of height in the corona; our observations are combined with spatial data from the Nancay Radioheliograph (NRH) whenever the need for 3D positional information arises.

The ARTEMIS-IV contribution in the study of Solar Radio Radiation, Energetic Events and Interplanetary Space Extensions include:

Research Using ARTEMIS-Jean Luis Steinberg (ARTEMIS-IV) in 2015-2018

The ARTEMIS-JLS is out of service since September 2013 due to a malfunction of the Antenna Steering System, therefore research work was based on the data archive of the instrument.

Future Perspectives

Restoration work on the Antenna System and modernization of the receivers is expected to begin in 2019 and restart of operations is envisaged within 2020. This project is funded by Onassis Foundation.

At this time the ARTEMIS-JLS web page provides on-line access to spectral data. These include the daily spectra of the ASG with a reduced time resolution of 5 seconds (Quick Looks) and the Type II List from 1998 to 2011; FITS data files are available with the latter. Although data of different time periods or higher resolution data are available on request, an extension of the on-line data availability is planned for the future as storage space in the University of Athens servers will become available. This work is also funded by the same grant.

We expect to continue obtaining high quality data to be used in improving our understanding of solar radio bursts and of the underlying physics of the corona and the interplanetary medium. The particular areas of interest include transient activity and flares, energy dissipation, electron acceleration and transport during flares, radio signatures of CMEs and coronal radio radiation amongst others. A major part of this work is expected to be based on comparisons of the ARTEMIS-JLS Radio Data with observations of HXR, energetic electrons, etc. The EUV and SXR imaging can put coherent emissions into context and may open exciting new possibilities for radio diagnostics unfolding their full potential as a tool for understanding plasma processes and energy release in the solar corona.

Publications:

- Maroulis et al: 1997, Solar Physics, 172, 353-360, «Artemis Mark-IV, the New Greek-French Digital Radio Spectrograph at Thermopylae, Greece»
- Caroubalos&al: «The New Multichannel Radio spectrograph ARTEMIS-IV/HECATE, of the University of Athens» Exp. Astron. 11: 23-32, 2001.
- Kontogeorgos&al: «Observing the Sun At 20-650Mhz at Thermopylae with Artemis» Space Sci. Rev. 122: 169-179 (2006a),
- Kontogeorgos&al: «The improved ARTEMIS IV Multichannel solar radio spectrograph of the University of Athens» Exp. Astron., 21, 41-55, (2006).
- Investigation of fine structures in radio events due to high sampling rate; small scale features of radio bursts are thus analyzed.
- Study of the association of solar bursts with interplanetary phenomena because of its extended frequency coverage which complements the WIND/WAVES receivers. The combined spectral data range from the base of the Solar Corona to the near Earth space.
- Examination of the radio signatures of solar energetic events, such as flares, CMEs and SEP events; the ARTEMIS-IV data are combined, in this case with GOES, SOHO/LASCO, STEREO/WAVES etc observations.
- C. Bouratzis, A. Hillaris, C. E. Alissandrakis, P. Preka-Papadema, X. Moussas, C. Caroubalos, P. Tsitsipis, and A. Kontogeorgos. «High resolution observations with Artemis-IV and the NRH. I. Type IV associated narrow-band bursts.» Astronomy & Astrophysics., 586:A29, 2016.
- Hillaris A, Bouratzis C, Nindos A. «Interplanetary type IV bursts.» Solar Physics. 2016; 291:2049-69.
- C. E. Alissandrakis, A. Nindos, S. Patsourakos, A. Kontogeorgos, P. Tsitsipis.: «A tiny event producing an interplanetary type III burst», Astronomy & Astrophysics, 582, A52 (2015).
- Kouloumvakos, A.; Nindos, A.; Valtonen, E.; Alissandrakis, C. E.; Malandraki, O.; Tsitsipis, P.; Kontogeorgos, A.; Moussas, X.; Hillaris, A.: «Properties of solar energetic particle events inferred from their associated radio emission», Astronomy & Astrophysics, 580, id.A80, 17 pp. (2015).
- Bouratzis, C.; Hillaris, A.; Alissandrakis, C. E.; Preka-Papadema, P.; Moussas, X.; Caroubalos, C.; Tsitsipis, P.; Kontogeorgos, A.: «Fine Structure of Metric Type IV Radio Bursts Observed with the ARTEMIS-IV Radio-Spectrograph: Association with Flares and Coronal Mass Ejections », Solar Physics, 290, pp.219-286 (2015).

University of Ioannina, Department of Physics, Section of Astrophysics, Laboratory of Astronomy

**Costas Alissandrakis (CA), Professor Emeritus of Astrophysics;
Alexander Nindos (AN), Associate Professor; Spiros Patsourakos (SP), Associate Professor.**

Infrastructures:

The Laboratory of Astronomy participates in the operation of the ARTEMIS-IV/Jean-Louis Steinberg solar radiospectrograph at Thermopylae, together with the National and Kapodistrian University of Athens and the Technological Educational Institute of Central Greece.

Contribution to International Associations:

- AN has been member of the Board of the Community of European Solar Radio Astronomers (CESRA).
- SP is the chair of Division IV of the International Association of Geomagnetism and Aeronomy (IAGA) since 2015.

Publications:

- Alissandrakis, C. E.; Nindos, A.; Patsourakos, S.; Kontogeorgos, A.; Tsitsipis, P., A tiny event producing an interplanetary type III burst, 2015, *Astronomy & Astrophysics*, Volume 582, id.A52, 9 pp
- Nindos, A.; Patsourakos, S.; Vourlidas, A.; Tagikas, C., How Common Are Hot Magnetic Flux Ropes in the Low Solar Corona? A Statistical Study of EUV Observations, 2015, *The Astrophysical Journal*, Volume 808, Issue 2, article id. 117, 15 pp..
- Kouloumvakos, A.; Nindos, A.; Valtonen, E.; Alissandrakis, C. E.; Malandraki, O.; Tsitsipis, P.; Kontogeorgos, A.; Moussas, X.; Hillaris, A., Properties of solar energetic particle events inferred from their associated radio emission, *Astronomy & Astrophysics*, Volume 580, id.A80, 17 pp.
- Wedemeyer, S.; Bastian, T.; Brajša, R.; Barta, M.; Hudson, H.; Fleishman, G.; Loukitcheva, M.; Fleck, B.; Kontar, E.; De Pontieu, B.; Tiwari, S.; Kato, Y.; Soler, R.; Yagoubov, P.; Black, J. H.; Antolin, P.; Gunár, S.; Labrosse, N.; Benz, A. O.; Nindos, A.; Steffen, M.; Scullion, E.; Doyle, J. G.; Zaqarashvili, T.; Hanslmeier, A.; Nakariakov, V. M.; Heinzel, P.; Ayres, T.; Karlicky, M., SSALMON - The Solar Simulations for the Atacama Large Millimeter Observatory Network, 2015, *Advances in Space Research*, Volume 56, Issue 12, p. 2679-2692.
- Nisticò, G.; Zimbardo, G.; Patsourakos, S.; Bothmer, V.; Nakariakov, V. M., North-south asymmetry in the magnetic deflection of polar coronal hole jets, 2015, *Astronomy & Astrophysics*, Volume 583, id.A127, 10 pp.
- Chintzoglou, G.; Patsourakos, S.; Vourlidas, A., Formation of Magnetic Flux Ropes during a Confined Flaring Well before the Onset of a Pair of Major Coronal Mass Ejections, 2015, *The Astrophysical Journal*, Volume 809, Issue 1, article id. 34,18.
- Bouratzis, C.; Hillaris, A.; Alissandrakis, C. E.; Preka-Papadema, P.; Moussas, X.; Caroubalos, C.; Tsitsipis, P.; Kontogeorgos, A., Fine Structure of Metric Type IV Radio Bursts Observed with the ARTEMIS-IV Radio-Spectrograph: Association with Flares and Coronal Mass Ejections, 2015, *Solar Physics*, Volume 290, Issue 1, pp.219-286
- Bogod, V. M.; Alissandrakis, C. E.; Kaltman, T. I.; Tokhchukova, S. K., RATAN-600 Observations of Small-Scale Structures with High Spectral Resolution, 2015, *Solar Physics*, Volume 290, Issue 1, pp.7-20
- Wedemeyer, S.; Bastian, T.; Brajša, R.; Hudson, H.; Fleishman, G.; Loukitcheva, M.; Fleck, B.; Kontar, E. P.; De Pontieu, B.; Yagoubov, P.; Tiwari, S. K.; Soler, R.; Black, J. H.; Antolin, P.; Scullion, E.; Gunár, S.; Labrosse, N.; Ludwig, H.-G.; Benz, A. O.; White, S. M.; Hauschildt, P.; Doyle, J. G.; Nakariakov, V. M.; Ayres, T.; Heinzel, P.; Karlicky, M.; Van Doorselaere, T.; Gary, D.; Alissandrakis, C. E.; Nindos, A.; Solanki, S. K.; Rouppe van der Voort, L.; Shimojo, M.; Kato, Y.; Zaqarashvili, T.; Perez, E.; Selhorst, C. L.; Barta, M., Solar Science with the Atacama Large Millimeter/Submillimeter Array—A New View of Our Sun, 2016, *Space Science Reviews*, Volume 200, Issue 1-4, pp. 1-73
- Kouloumvakos, A.; Patsourakos, S.; Nindos, A.; Vourlidas, A.; Anastasiadis, A.; Hillaris, A.; Sandberg, I., Multi-viewpoint Observations of a Widely distributed Solar Energetic Particle Event: The Role of EUV Waves and White-light Shock Signatures, 2016, *The Astrophysical Journal*, Volume 821, Issue 1, article id. 31, 15 pp.
- Patsourakos, S.; Georgoulis, M. K.; Vourlidas, A.; Nindos, A.; Sarris, T.; Anagnostopoulos, G.; Anastasiadis, A.; Chintzoglou, G.; Daglis, I. A.; Gontikakis,

- C.; Hatzigeorgiu, N.; Iliopoulos, A. C.; Katsavrias, C.; Kouloumvakos, A.; Moraitis, K.; Nieves-Chinchilla, T.; Pavlos, G.; Sarafopoulos, D.; Syntelis, P.; Tsironis, C.; Tziotziou, K.; Vogiatzis, I. I.; Balasis, G.; Georgiou, M.; Karakatsanis, L. P.; Malandraki, O. E.; Papadimitriou, C.; Odstrčil, D.; Pavlos, E. G.; Podlachikova, O.; Sandberg, I.; Turner, D. L.; Xenakis, M. N.; Sarris, E.; Tsinganos, K.; Vlahos, L., The Major Geoeffective Solar Eruptions of 2012 March 7: Comprehensive Sun-to-Earth Analysis, 2016, *The Astrophysical Journal*, Volume 817, Issue 1, article id. 14, 21 pp.
- Raouafi, N. E.; Patsourakos, S.; Pariat, E.; Young, P. R.; Sterling, A. C.; Savcheva, A.; Shimojo, M.; Moreno-Insertis, F.; DeVore, C. R.; Archontis, V.; Török, T.; Mason, H.; Curdt, W.; Meyer, K.; Dalmasse, K.; Matsui, Y., *Solar Coronal Jets: Observations, Theory, and Modeling*, 2016, *Space Science Reviews*, Volume 201, Issue 1-4, pp. 1-53
 - Patsourakos, S.; Georgoulis, M. K., Near-Sun and 1 AU magnetic field of coronal mass ejections: a parametric study, 2016, *Astronomy & Astrophysics*, Volume 595, id.A121, 8 pp.
 - Hillaris, A.; Bouratzis, C.; Nindos, A., 2016, *Interplanetary Type IV Bursts*, 2016, *Solar Physics*, Volume 291, Issue 7, pp.2049-2069
 - Syntelis, P.; Gontikakis, C.; Patsourakos, S.; Tsinganos, K., 2016, The spectroscopic imprint of the pre-eruptive configuration resulting into two major coronal mass ejections, *Astronomy & Astrophysics*, Volume 588, id.A16, 14 pp.
 - Bouratzis, C.; Hillaris, A.; Alissandrakis, C. E.; Preka-Papadema, P.; Moussas, X.; Caroubalos, C.; Tsitsipis, P.; Kontogeorgos, A., High resolution observations with Artemis-IV and the NRH. I. Type IV associated narrow-band burst, 2016, *Astronomy & Astrophysics*, Volume 586, id.A29, 11 pp.
 - Klimchuk, J. A.; Patsourakos, S.; Tripathi, D., 2016, Intensity Conserving Spectral Fitting, 2016, *Solar Physics*, Volume 291, Issue 1, pp.55-65
 - Alissandrakis, C. E.; Patsourakos, S.; Nindos, A.; Bastian, T. S., Center-to-limb observations of the Sun with ALMA . Implications for solar atmospheric models, 2017, *Astronomy & Astrophysics*, Volume 605, id.A78, 5 pp.
 - Alissandrakis, C. E.; Koukras, A.; Patsourakos, S.; Nindos, A., Evidence for two-loop interaction from IRIS and SDO observations of penumbral brightenings, 2017, *Astronomy & Astrophysics*, Volume 603, id.A95, 13 pp.
 - Patsourakos, S.; Georgoulis, M. K., A Helicity-Based Method to Infer the CME Magnetic Field Magnitude in Sun and Geospace: Generalization and Extension to Sun-Like and M-Dwarf Stars and Implications for Exoplanet Habitability, 2017, *Solar Physics*, Volume 292, Issue 7, article id.89, 22 pp.
 - Alissandrakis, C. E.; Vial, J.-C.; Koukras, A.; Buchlin, E.; Chane-Yook, M., IRIS Observations of Spicules and Structures Near the Solar Limb, 2018, *Solar Physics*, Volume 293, Issue 2, article id. 20, 30 pp.
 - Kontar, E. P.; Nindos, A., Combined Radio and Space-Based Solar Observations: From Techniques to New Results – Preface, 2018, *Solar Physics*, Volume 293, Issue 6, article id. 90, 4 pp.
 - Nindos, A.; Kontar, E.P.; Oberoi, D., *Solar Physics with the Kilometre Square Array*, 2018, *Advances in Space Research* (accepted for publication)
 - Nindos, A.; Alissandrakis, C. E.; Bastian, T. S.; Patsourakos, S.; De Pontieu, B.; Warren, H.; Ayres, T.; Hudson, H. T.; Shimizu, T.; Vial, J.-C.; Wedemeyer, S.; Yurchyshyn, V.; 2018, First high resolution look at the quiet Sun with ALMA at 3mm, *Astronomy and Astrophysics* (accepted for publication)

Invited talks in International Conferences:

- C. E. Alissandrakis: “Radio Emission from Solar Active Regions”, 26th General Assembly of the International Union of Geodesy and Geophysics (IUGG), Prague, June 28 – July 2, 2015.
- C. E. Alissandrakis: “High time resolution observations of fine structures in metric radio bursts with ARTEMIS/JLS and the Nançay Radioheliograph”, The legacy of Jean-Louis Steinberg, Paris, 6-10 November 2017.
- A. Nindos: “The Pre-eruptive Configuration of Large Solar Events” in the “Solar Variability and its Heliospheric Effects” conference organized by the “Balkan, Black Sea and Caspian Sea Regional Network on Space Weather Studies”, Athens, November 2015.
- A. Nindos: “The Pre-eruptive Configuration of Large Solar Events” in EGU General Assembly, Vienna, April 2017.
- A. Nindos: “Solar Physics with the Square Kilometre Array” in the 15th European Solar Physics Meeting, Budapest, September 2017.
- A. Nindos: “Cool and Hot Flux Ropes, Their Helicity” in COSPAR 42nd Assembly, Pasadena (USA), July 2018.
- S. Patsourakos: “EUV Coronal Waves: Atmospheric and Heliospheric Connections and Energetics”, 2015 AGU Fall, San Francisco, USA, 14-18 December 2015.
- S. Patsourakos: “Coronal Mass Ejections: An Account of Recent Observations, The First China-Europe Solar Physics Meeting”, Kunming, China, 15-19 May 2017

International Research Projects:

- Collaboration with the St Petersburg Branch of the Special Astronomical Observatory (SAO) of the Russian Academy of Sciences on Solar observations and analysis with the RATAN-600 radio telescope.
- WG5 (Bs Challenge Group) of Variability of the Sun and Its Terrestrial Impact (VarSITI) International Study of Earth-affecting Solar Transients International initiative.
- International Study Team on the “Decoding the Pre-Eruptive Magnetic Configurations of Coronal Mass Ejections” of the International Space Science Institute

Research Center for Astronomy and Applied Mathematics of the Academy of Athens

Costis Gontikakis (CG) and Manolis Georgoulis (MG), both Senior Researchers.

Infrastructures:

RCAAM is an Expert Group of the ESA Space Situational Awareness (SSA) Solar Weather Expert Service Center (S-ESC). It hosts and maintains the Athens Effective Solar Flare Forecasting (A-EFFort) facility that is a federated ESA SSA/SWE service and provides near-realtime 24-hour forecasts for four classes of major solar refreshed every 3 hours. MG serves as the A-EFFort Project Manager.

Moreover, RCAAM is the Coordinator institution of the Flare Likelihood and Region Eruption Forecasting (FLARECAST), again on solar flare prediction, with its computing facility based at Universite Parid-Sud, France. MG served as the FLARECAST Project Coordinator.

Contribution to International Associations:

- CG is currently the Secretary of the Hellenic Astronomical Society (Hel.A.S.).
- MG is a past President of the Solar Physics Division of the European Physical Society (ESPD/EPS; 2014 – 2017), a past National Delegate for Greece in ESA's Science Programme Committee (ESA/SPC; 2011 – 2017) and a past Vice-President and Secretary of Hel.A.S. (2014 – 2016 and 2016 – 2018, respectively).
- MG is the current National Delegate for Greece in the Committee on Space Research (COSPAR). He is also the Executive Director of the Local Organizing Committee from COSPAR General Assembly 2022, that will be organized in Athens, Greece.
- MG is the current Vice-President of Commission E2 on Solar Activity of the International Astronomical Union (IAU).

Publications:

- Syntelis, P., Archontis, V., Gontikakis, C. & Tsinganos, K.: Emergence of non-twisted magnetic fields in the Sun: Jets and atmospheric response, 2015, *Astron. Astrophys.*, 584:A10, DOI: 10.1051/0004-6361/201423781
- Rohan, L. E., Ravindra, B., Georgoulis, M. K., & Kueker, M.: Analyzing the Effects of Apodising Windows on Local Correlation Tracking Using Nirvana Simulations of Convection, 2015, *Solar Phys.*, 290:1135, DOI: 10.1007/s11207-015-0659-2
- Patsourakos, S., Georgoulis, M. K., Vourlidis, A. et al.: The Major Geoeffective Solar Eruptions of 2012 March 7: Comprehensive Sun-to-Earth Analysis, 2016, *Astrophys. J.*, 817:14, DOI: 10.3847/0004-637X/817/1/14
- Syntelis, P., Gontikakis, C., Patsourakos, S. & Tsingakos, K: The spectroscopic imprint of the pre-eruptive configuration resulting into two major coronal mass ejections, 2016, *Astron. Astrophys.*, 588:A16, DOI: 10.1051/0004-6361/201526829
- Gontikakis, C. & Vial, J.-C.: Evidence of scattering effects influenced by plasma flows in C VI 1548 Å, 1550 Å spectral lines emitted from the Sun, 2016, *Astron. Astrophys.*, 590:86, DOI: 10.1051/0004-6361/201628109
- Gontikakis, C. & Vial, J.-C.: Effects of resonant scattering of the Si IV doublet near 140 nm in a solar active region, 2018, *Astron. Astrophys.*, in press, DOI: 10.1051/004-6351/201732563
- Aschwanden, M. J., Crosby, N. B., Dimitropoulou, M., Georgoulis M. K. et al.: 25 Years of Self-Organized Criticality: Solar and Astrophysics, 2016, *Space Sci. Rev.*, 198:47, DOI:10.1007/s11214-014-0054-6
- McAteer, R. T. J., Aschwanden, M. J., Dimitropoulou, M., Georgoulis, M. K. et al.: 25 Years of Self-Organized Criticality: Numerical Detection Methods, 2016, *Space Sci. Rev.*, 198:217, DOI: 10.1007/s11214-015-0158-7
- Barnes, G., Leka, K. D., Schrijver, C. J., et al.: A Comparison of Flare Forecasting Methods. I. Results from the “All-Clear” Workshop, 2016, *Astrophys. J.*, 829:89, DOI: 10.3847/0004-637X/829/2/89
- Patsourakos, S. & Georgoulis, M. K.: Near-Sun and 1 AU Magnetic Field of Coronal Mass Ejections: a Parametric Study, 2016, *Astron. Astrophys.*, 595:A121, DOI: 10.1051/0004-6361/201628277
- Moraitis, K., Toutountzi, A., Isliker, H., Georgoulis, M., Vlahos, L., & Chintzoglou, G.: An Observationally-Driven Kinetic Approach to Coronal Heating, 2016, *Astron. Astrophys.*, 596:A56, DOI: 10.1051/0004-6361/201527890
- Valori, G., Pariat, E., Anfinogentov, S., Chen, F., Georgoulis, M. K., Guo, Y., Liu, Y., Moraitis, K., Thalmann, J., & Yang, S.: Magnetic Helicity Estimations in Models and Observations of the Solar Magnetic Field. Part I: Finite Volume Methods, 2016, *Space Sci. Rev.*, 201:147, DOI: 10.1007/s11214-016-0299-3

- Papaioannou, A., Sandberg, I., Anastasiadis, A., Kouloumvakos, A., Georgoulis, M. K., Tziotziou, K., Tsiropoula, G., Jiggins, P., & Hilgers, A.: Solar Flares, Coronal Mass Ejections and Solar Energetic Particles Event Characteristics, *J. Space Wea. Space Clim.*, 6:A42, DOI: 10.1051/swsc/2016035
- Patsourakos, S. & Georgoulis, M. K.: A Helicity-Based Method to Infer the CME Magnetic Field Magnitude in Sun and Geospace: Generalization and Extension to Sun-Like and M-Dwarf Stars and Implications for Exoplanet Habitability, 2017, *Solar Phys.*, 292:89, DOI: 10.1007/s11207-017-1124-1
- Guo, Y., Pariat, E., Valori, G., Anfinogentov, S., Chen, F., Georgoulis, M. K., Liu, Y., Moraitis, K., Thalmann, J. K., & Yang, S.: Magnetic Helicity Estimations in Models and Observations of the Solar Magnetic Field. III. Twist Number Method, 2017, *Astrophys. J.*, 840:40, DOI: 10.3847/1538-4357/aa6aa8
- Kontogiannis, I., Georgoulis, M. K., Park, S.-H., & Guerra, J. A.: Non-neutralized Electric Currents in Solar Active Regions and Flare Productivity, 2017, *Solar Phys.*, 292:159, DOI: 10.1007/s11207-017-1185-1
- Anastasiadis, A., Papaioannou, A., Sandberg, I., Georgoulis, M. K., Tziotziou, K., Kouloumvakos, A. & Jiggins, P.: Predicting Flares and Solar Energetic Particle Events: The FORSPEF Tool, 2017, *Solar Phys.*, 292:134, DOI: 10.1007/s11207-017-1163-7
- Guerra, J. A., Park, S.-H., Gallagher, P. T., Kontogiannis, I., Georgoulis, M. K. & Bloomfield, D. S.: Active Region Photospheric Magnetic Properties Derived from Line-of-Sight and Radial Fields, 2018, *Solar Phys.*, 293:9, DOI: 10.1007/s11207-017-1231-z
- Kontogiannis, I., Gontikakis, C., Tsiropoula, G. & Tziotziou, K.: Probing the Quiet Solar Atmosphere from the Photosphere to the Corona, 2018, *Solar Phys.*, 293:56, DOI:10.1007/s11207-018-1275-8
- Florios, K., Kontogiannis, I., Park, S.-H., Guerra, J. A., Benvenuto, F., Bloomfield, D. S. & Georgoulis, M. K.: Forecasting Solar Flares Using Magnetogram-based Predictors and Machine Learning, 2018, *Solar Phys.*, 293:28, DOI: 10.1007/s11207-018-1250-4
- Kontogiannis, I., Georgoulis, M., K., Park, S.-H. & Guerra, J. A.: Testing and Improving a Set of Morphological Predictors of Flaring Activity, 2018, *Solar Phys.*, 293:96, DOI: 10.1007/s11207-018-1317-2
- Park, S.-H., Guerra, J. A., Gallagher, P. T., Georgoulis, M. K. & Bloomfield, D. S.: Photospheric Shear Flows in Solar Active Regions and Their Relation to Flare Occurrence, 2018, *Solar Phys.*, 293:114, DOI: 10.1007/s11207-018-1336-z
- Georgoulis, M. K., Papaioannou, A., Sandberg, I., Anastasiadis, A., Daglis, I., Rodriguez-Gasen, R., Aran, A., Sanahuja, B. & Piemenin, P.: Analysis and interpretation of inner-heliospheric SEP events with the ESA Standard Radiation Environment Monitor (SREM) onboard the INTEGRAL and Rosetta Missions, 2018, *J. Space Wea. Space Clim.*, 8:40, DOI: 10.1051/swsc/2018027
- Massone, A. M., Piana, M., Georgoulis, M. K. et al.: Machine Learning for Flare Forecasting, Invited in *Machine Learning Techniques for Space Weather* (E. Camporeale, J. Johnson & S. Wing, Editors), Chapter 14, 2018, Eslevier, ISBN: 978-0-12-811788-0
- Georgoulis, M. K.: The Ambivalent Role of Field-Aligned Electric Currents in the Solar Atmosphere, Invited in *Electric Currents in Geospace and Beyond* (A. Keiling, O. Marghita & M. Wheatland, Editors), Chapter 22, 2018, AGU Monograph Series 235, ISBN: 978-1-119-32449-2

Invited talks in International Conferences:

- MG: Tracing the Origins of Solar Magnetic Eruptions, 26th International Union of Geodesy and Geophysics (IUGG) General Assembly, Prague, Czech Republic, June 22 – July 5, 2015
- MG: Greece and ESA's Science Programme Committee: National Involvement, 12th Hellenic Astronomical Conference, Thessaloniki, Greece, June 28 – July 2, 2015
- MG: Solar Eruption Prediction: Status, Science, Open Questions, Solar Variability and Its Heliospheric Effects, International Conference, Athens, Greece, November 2 – 6, 2015
- MG: Electric Currents in the Solar Atmosphere, American Geophysical Union (AGU) Chapman Meeting in Currents in Geospace and Beyond, Dubrovnik, Croatia, May 23 – 27, 2016
- MG: The Path of Certain Active Regions Toward Eruptions and Implications for Solar-Eruptions Forecasting, 2016 European Week of Astronomy and Space Science (EWASS), Athens, Greece, July 4 – 8, 2016
- MG: Comparing Different Solar Flare Prediction Methods (Keynote), 13th European Space Weather Week (ESWW13), Ostend, Belgium, November 14 – 18, 2016
- MG: The SSA SWE A-EFFort Service: Successes and Shortcomings of Operational Solar Flare Prediction, 13th European Space Weather Week (ESWW13), Ostend, Belgium, November 14 – 18, 2016
- MG: Introduction to FLARECAST, 13th European Space Weather Week (ESWW13), Ostend, Belgium, November 14 – 18, 2016
- MG: ISSI Pre-Eruptive Stage Part II, ISSI Workshop on Decoding the Pre-Eruptive Magnetic Configuration of Coronal Mass Ejections, May 8 – 11, 2017
- MG: FLARECAST: The Fully Automated Solar Flare Forecasting System, PROGRESS Summer School, Majorca, Spain, July 26 – 28, 2017
- MG: Progress and Challenges Toward a Future Integrated Space Weather Forecasting System, SEPRAD Expert Workshop, Vienna, Austria, September 18 – 19, 2017
- MG: ESA/SSA SWE A-EFFort Service, PSTEP Flare Prediction Workshop, Nagoya, Japan, October 31 – November 3, 2017
- MG: FLARECAST Status Update, PSTEP Flare Prediction Workshop, Nagoya, Japan, October 31 – November 3, 2017
- MG: Magnetic Helicity in the Solar Atmosphere: Much Gained, Still a Lot to Learn, Third Helicity Thinkshop, Tokyo, Japan, November 19 – 23, 2017
- MG: Remote-Sensing Magnetograph Observations with Solar Orbiter: Issues and Caveats, Solar Orbiter MADAWG Meeting, Toulouse, France, January 22 – 24, 2018
- MG: Coupling Heliophysics With Machine-Learning to Address Contemporary Space Weather Forecasting Problems (Keynote), High-Performance Computing at Sheffield University Workshop, Sheffield, UK, March 26, 2018
- MG: Pre-Eruption Conditions in Solar Active Regions: O2R and a Meaningful EST Role, European Solar Telescope Science Meeting, Giardini Naxos, Italy, June 11 – 15, 2018
- MG: Solar Radiation, First EMF and Health Symposium, Athens, Greece, September 14 – 15, 2018
- MG: Tools and Results of the FLARECAST Project Useful to Solar Orbiter Operations, Solar Orbiter MADAWG Meeting, Athens, Greece, September 26 – 28, 2018
- MG: European Efforts for Heliophysics Data Integration and Assimilation, EarthCube RCN Workshop: "Toward Integration of Heliophysics Data, Modeling and Analysis Tools", New Jersey Institute of Technology, Newark, NJ, USA, November 14 – 16, 2018

International Research Projects:

- MG – Coordinator, ISSI Team on Improving the Reliability of Solar Eruptions to Facilitate the Determination of Targets-of-Opportunity for Instruments with a Limited Field of View, International Space Science Institute (ISSI) Bern, 2015 – 2016
- MG – Project Coordinator, Flare Likelihood and Region Eruption Forecasting (FLARECAST), EU Horizon 2020, 2015 – 2018
- CG – Team Member, Flare Likelihood and Region Eruption Forecasting (FLARECAST), EU Horizon 2020, 2015 – 2018
- MG – Project Manager, Athens Effective Solar Flare Forecasting, ESA SSA/SWE, 2014 – 2018
- MG – Team Member, ISSI Team on Magnetic Helicity, ISSI Bern, 2014 – 2016
- MG – Team Member, Forecasting Solar Particle Events and Flares (FORSPEF), ESA, Implemented by the National Observatory of Athens, 2014 – 2015
- CG & MG – Team Members, Solar Small-Scale Events and their Role in the Heating of the Solar Atmosphere, “Excellence II” Project of the Greek National Secretariat for Research and Technology (GSRT), Implemented by the National Observatory of Athens, 2013 – 2015
- MG – Local Team Leader, Hellenic National Space Weather Research Network, “Thales” Project of the GSRT, Implemented by the University of Thessaloniki, 2012 – 2016
- CG – Team Member, Hellenic National Space Weather Research Network, “Thales” Project of the GSRT, Implemented by the University of Thessaloniki, 2012 – 2016
- MG – Project Member, ISSI Team on Study of Magnetic Flux Ropes Before and During Onset of Solar Coronal Mass Ejections, ISSI Bern, 2016 – 2017
- MG – Team Member, Advanced Solar Particle Events Casting System (ASPECS), ESA, Implemented by the National Observatory of Athens, 2017 – 2019

Division 5: Geomagnetic Observatories, Surveys and Analyses

National Observatory of Athens / National and Kapodistrian University of Athens

Dr. Georgios Balasis and Prof. Ioannis A. Daglis

ENIGMA

The National Observatory of Athens (NOA) currently operates ENIGMA (Hellenic GeoMagnetic Array), an array of 4 ground-based magnetometer stations in the areas of Trikala (Klokotos), Attiki (Dionysos), Lakonia (Velies) and Lasithi (Finokalia) that provides measurements for the study of geomagnetic pulsations, resulting from the solar wind - magnetosphere coupling (<http://enigma.space.noa.gr/>). ENIGMA is the first magnetometer station array to operate in Greece, and within a few years of operation has achieved the status of a SuperMAG contributor. ENIGMA monitors the variations of the geomagnetic field associated with the occurrence of geospace magnetic storms and magnetospheric ultra low frequency (ULF) electromagnetic waves. One of the ENIGMA main research objectives is the study of space weather effects on the ground, i.e., Geomagnetically Induced Currents (GIC).

Division 6: Electromagnetic Induction in the Earth and Planetary Bodies

Democritus University of Thrace

Prof Konstantinos Kourtidis

Infrastructures:

Demokritus University of Thrace (DUTH) XANTHI Site of Atmospheric electricity measurements:

Name of site	DUTH Xanthi
Site location (including lat/lon)	Demokritus University of Thrace, Campus, 67100 Kimeria-Xanthi, Greece 41.15° N, 24.92° E, 75 m ASL
Host institute for the site	Demokritus University of Thrace
Site point of contact	Prof. Konstantinos Kourtidis
Site point of contact email	kourtidi@env.duth.gr
Short summary of the site characteristics	<i>Type:</i> rural <i>Location:</i> At the edge of a smooth, S-facing slope with a valley reaching the seashore about 20 km to the S and the E-W oriented Rodopi Mountain Range located to the N. 1.7 km from Xanthi (population 65,000) <i>Ground surface:</i> Soil and grass Light-traffic road oriented east– west [traffic density of 10 (nighttime) to 150 (rush hours) cars/hr 120 m to the S No obstacles closer than 30 m, protruding <18° above the horizon

Variabl e	Device	Data logging	Sampli ng rate	Transmissio n	Retrieval and Recording
Atmosp heric electric field (PG)	CS110 Campbell Sci.	Onboard CR1000 Campbell Sci.	1 Hz	Every 2min	Via intranet using Loggernet
Meteo (WV, Wdir, T, RH, P, Rain)	Wind Sentry Young (MODEL 03002L), Rotronic Hygroclip (S3), Barometer Vaisala (PTB110), Rain gauge Young (MODEL	No data logging. Signal digitization using ADAM modules and on line transmission to PC	1 Hz	constantly	Via intranet using DasyLab

	52202)				
CO2	M1-K, Schumann Analytics	No data logging, A/D conversion and cable connection to PC	1 Hz	constantly	Cable connection using DasyLab

1-min data (for PG also 1 sec data) are stored at a PC which is periodically synchronized with the NIST time server.

International Research Programs:

- «*Global Coordination of Atmospheric Electricity Measurements (GLOCAEM)*» (P.I.), National Environment Research Council (NERC), U.K., 3.2016-2.2017.
- «*Atmospheric Electricity Network: coupling with the Earth System, climate and biological systems (ELECTRONET)*» (Coordinator), E.U., COST, 11.2016-10.2020.

Publications:

- Kastelis N. and K. Kourtidis, Characteristics of the atmospheric electric field and correlation with CO2 at a rural site in southern Balkans. *Earth, Planets Sp.*, 68, 3, 2016 doi:10.1186/s40623-016-0379-3.
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Technological Education Institute of Crete

Prof. Filippos Vallianatos, Prof. John P. Makris and the TEICR-LGS team

The Geophysics and Seismology Laboratory of the Technological Educational Institute of Crete (LGS-TEICR) has been ceaselessly contributing the last two decades to the advancements made in Geophysics and Seismology with emphasis to the study of broad region of Crete accumulating years of experience. Major advances were made in the field of Geophysics, based on the application of seismic and electromagnetic methods with special focus on magnetotellurics and seismoelectromagnetism.

LGS-TEICR employs advanced technology in Seismology and Geophysics and its greatest research strengths are in network seismology, tectonics, earthquake source physics, non-extensive statistical physics in seismology and geophysics, physics of geomaterials, earthquake hazard and risk assessment and mitigation, exploration and engineering seismology, theoretical seismic wave propagation, remote sensing and GIS, seismoelectromagnetism and earthquake prediction.

LGS-TEICR is concerned with the understanding the cause and mechanism of earthquakes and with determining the structure of the Earth's interior, using seismic waves and geophysical methods with emphasis to time domain electromagnetics and magnetotellurics.

Its research group comprises an effective blend of scientists in the research topics of seismology, geophysics, geophysical instrumentation and geoinformatics.

LGS-TEICR coordinates or participates to a great number of national & international research programs and projects and collaborates with numerous Universities and Research Institutes abroad (mainly European and Japanese).

Affiliated with LGS-TEICR is UNESCO Chair on “Solid Earth Physics and Geohazards Risk Reduction“, holder Prof. Filippos Vallianatos, and its mission is to provide leadership, expertise and research into creating a sustainable geoenvironment through the understanding of Earth Physics laws.

IGA related activities in the recent past:

Since 2012 a great number of onshore magnetotelluric (MT) and Transient Electromagnetic (TEM) measurements have been conducted in Southern Aegean, Greece. The survey included Crete, almost all the islands of Dodecanese and Southern Cyclades, Southern Peloponnese, and the islands Kithira, Antikithira and Gavdos. The bi-annual campaign comprised more than 40 broad-band MT soundings combined in most cases with TEM, in order to contribute to the investigation of the geoelectric structure of Southern Aegean, and particularly of the Hellenic Subduction Zone.

A number of seismoelectromagnetic (SEM) stations have been installed and continuously operated until the end of 2015 in the south front of the Hellenic Arc. The first one installed in early 2013 at Omalos plateau, W. Crete (N35.33, E23.89). The second one installed on April 2014 in Rhodes Island (N36.17, E27.97). By constraining the study of seismicity in the geographical window N34.5 – 37.0, E22.5 – 29.0 and for the time period from July 2013 till April 2015, there is manifestation of possible precursory seismoelectric signatures observed at either station for the majority of earthquakes above M 4.5.

LGS-TEICR collaborated with INGV’s Project Unit “Measurements and Methods in Environmental Geophysics” for the implementation in Crete of ELF-VLF seismoelectromagnetic stations based on a prototype system with a customized broadband antenna (Nardi et al, 2007) aiming to investigate the existence VLF signals similar to VLF electromagnetic emissions from rock samples with various lithologies subjected to fracture to uniaxial compression in the laboratory.

Since April 2005 and for more than six years, there was a fruitful collaboration between LGS-TEICR and the Project Unit “Physics of the Upper Atmosphere” of INGV for oblique-incidence ionospheric sounding as a tool to test ionospheric radio propagation prediction methods. Several oblique sounding campaigns were conducted using Barry Research transmitters/receivers located in UK, Italy and Greece. Regular ionospheric measurements have been performed over the radiolinks Inskip (N53.51, W2.51, UK) – Rome (N41.81, E12.51, Italy) and Inskip – Chania (N35.71, E24.01, Greece) where the receivers were placed. Different long-term (i.e. monthly median) ionospheric predictions and nowcasting techniques and models have been applied and compared with the oblique-incidence radio sounding measurements, as well as the test and validation of the innovative IONORT-ISP system.

During the period 2007 till 2012 INGV and TEI of Crete managed a network of two high sampling rate (50 Hz) GNSS receivers at low latitude Mediterranean sites: Lampedusa (Sicily) and Chania (Crete). The research activities focused on the morphology and dynamics of the ionospheric plasma to improve the capabilities of TEC and scintillation mapping and modelling. The collaboration was extended into the MIRTO (Mediterranean Ionosphere with Real-time TOMography) project aimed to realize a prototype system able to produce real-time imaging of the ionosphere over the Mediterranean region.