



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

ANNUAL REPORT 2021

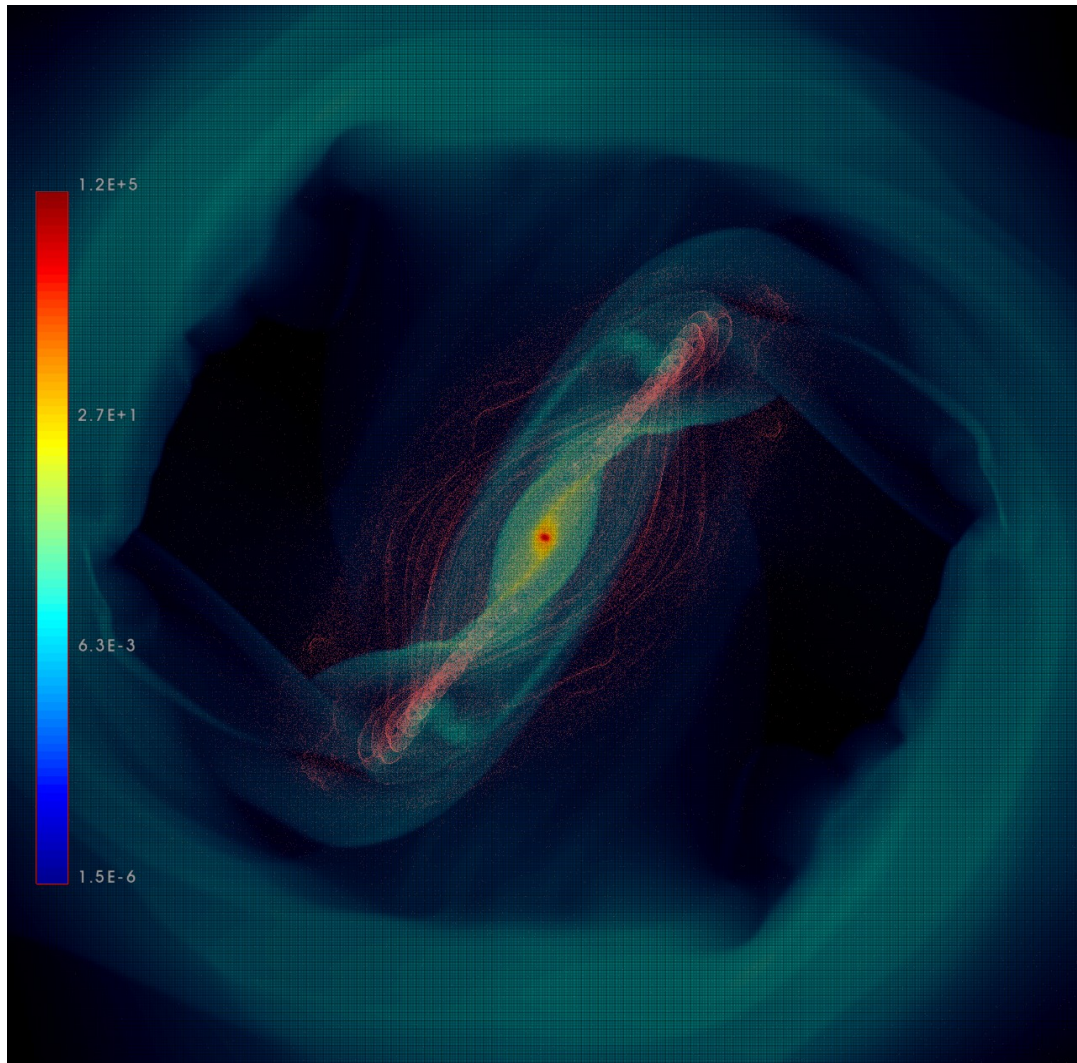


Figure: The gas response with sound velocity 20 km/s by superposing trajectories calculated in a model proposed for the galaxy NGC 7479. The trajectories are characterized by big loops covering areas close to the ends of the bar. The gas avoids these regions (Pastras et al. 2022, in preparation).

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Collaborations Between RCAAM and other research institutes :¹

RCAAM has collaborations with researchers at: National Observatory of Athens program "1" - observations with the Aristarchos telescope at Helmos), University of Padova, Italy, (programs "1", "3", "25), Laboratoire d'Astrophysique de Marseille (LAM), of the University Aix- Marseille, Marseille, France (program "4"), University of Cape Town., S. Africa, (program "5"), Technische Universität Dresden, Γερμανία, (program "5"), Max- Planck Institut für Astrophysik, Μόναχο, Γερμανία (program "6"), European Southern Observatory, Munich, Germany, Γερμανία (program "6"), International Space Science Institute (ISSI) Bern, Switzerland (program "7"), Max-Planck Institut für Radioastronomie, Bonn, Germany (program "8"), Instituto de Radio Astronomia Milimetric (IRAM), Granada (program "8"), NASA, Goddard Space Flight Center, Maryland, ΗΠΑ (program "9"), Aristotle University of Thessaloniki (programs "10", "11"), European University of Cyprus (program "12"), National Technical University of Athens (program "12"), Virginia-Tech, USA ΗΠΑ (program "12"), European Space Agency (ESA) (programs "13", "14", "15"), NASA Solar Radiation Analysis Group (SRAG), USA (programs "16"), Georgia State University, USA (programs "17", "20", "21", "22"), University of Helsinki, Finland (programs "18"), Lockheed Martin Solar & Astrophysical Laboratory, USA (programs "19"), International Space Science Institute (ISSI) Beijing, China (program "23"), University of Catania, Italy (programs "23"), NASA Ames Space Flight Center, ΗΠΑ, (program "24"), University of Krakow, Poland (program "26").

¹The numbers correspond to the number of the program in the section of the research programs of RCAAM.

About us

The Research Center for Astronomy and Applied Mathematics (RCAAM), is one of the Research Institutes of the Academy of Athens.

The main competences of RCAAM are Galactic Dynamics and Galactic Morphology, Nonlinear Dynamics and Chaos Theory, Solar Physics, Magnetohydrodynamics, Cosmology and Gravitation.

We are working towards comparing theoretical results with observational data from ground based as well as from space observatories (VLT, Solar Dynamics Observatory, etc.). The main scientific goals for the period 2019-20 include the study of the role of Chaos in supporting structures in Nbody simulations, the Dynamics of the Milky Way and other galaxies, the investigation of Chaos in quantum systems, the study of the magnetic connectivity in the active-regions of the solar atmosphere, the investigation of particle acceleration in the pulsar magnetosphere and the time profiles of the resulting high energy radiation, the formation and evolution of Structures in Cosmology as well as the nature of dark matter and dark energy.

A number of young researchers are coming to our Institute and successfully complete their PhD and Masters Theses. The researchers of our institute participate in fourteen (14) supervising committees of PhD and MSc theses. RCAAM members participated in the teaching of the courses "Galactic and Extragalactic Astronomy", "Dynamical Astronomy" and "Cosmology" at the Department of Physics of University of Athens.

RCAAM organizes since 1997 a seminar on a weekly basis, during the whole year, with speakers leading scientists from Greece and abroad. The talks are attended by many researchers, university professors and young scientists. RCAAM has organized in 2002 and 2007 international conferences on "Galaxies and Chaos" and on "Chaos in Astronomy" respectively. This series of conferences is planned to be continued during the next years. Another conference organized with great success by our Institute was the conference "Classical and Quantum Gravity", Crete 2009. Members of RCAAM participated also in the organization of several more conferences in Greece and abroad. Many other talks for the broad public are given every year by the researchers of RCAAM.

History

The Research Center for Astronomy and Applied Mathematics was established in 1959 initially as "Office for Research and Calculations", to promote scientific research in Astronomy and Applied Mathematics and to perform calculations related to these topics. In 1966 has been renamed "Research Center for Astronomy and Applied Mathematics". Since then scientific research has been conducted in the following fields, which are also the current working areas:

- Dynamical Astronomy, Nonlinear phenomena and applications of Chaos Theory in Astronomy
- Galactic Dynamics and Galactic Morphology
- Solar Physics and Relations between Solar and Terrestrial Phenomena
- Magnetohydrodynamics
- Cosmology and Gravitation
- A recently added research field is the study of electromagnetic waves of extremely low frequency (ELF) at 2-50 Hz.

The first supervisor of the "Office for Research and Calculations", and later of the "Research Center for Astronomy and Applied Mathematics", was Academician Prof. I. Xanthakis, until his death on 10 July 1994. During the years 1994-1997 the Research Center was supervised by Academician Prof. N. Artemiadis. After 1997 the supervisor is Academician Prof. G. Contopoulos.

As directors have served in the past Dr. L. Mavridis (1960-1966), Dr. K. Makris (1971-1979), Dr. K. Poulakos (1981-2001), Dr. N. Voglis (2001-2007), Dr. V. Tritakis (2007), Dr. E. Dara (2008). Since 2009 acting director of the Center is Dr. P.A. Patsis. Researchers who have worked in the past in the Research Center were Dr. I. Lyritzis, Dr. V. Petropoulos and Dr. Th. Zachariadis.

Our Research

Nonlinear & Chaotic Dynamics

The research that is carried out in Nonlinear and Chaotic Dynamics has as goal the investigation in depth of chaotic phenomena and the application of Chaos theory in solving astronomical problems as well as problems in dynamics that are encountered in other science disciplines. The term "Chaos" means that the laws of Physics allow limited predictability, despite the fact that these laws are expressed by rigorous mathematical equations. Although the Theory of Chaos was first applied in astronomical dynamical systems, today it finds applications to various phenomena of interest for everyday life (for example: earth and space weather forecasting, earthquakes, development of complex digital networks etc.).

Galactic Dynamics & Galactic Morphology

Galactic Dynamics is the tool to understand the observed Morphology of disk and elliptical galaxies. Our research combines Orbital Theory, N-body Simulations and Hydrodynamics with Observations in large telescopes. The orbital analysis of bars and spirals in 2D and 3D models has revealed the dynamical phenomena that shape the forms of elliptical galactic systems, the spirals of normal and barred-spiral galaxies, as well as the edge-on profiles of galactic disks. In the last years research in this field in our Institute has underlined the role of chaotic orbits in reinforcing the spiral structure in barred-spiral systems and in the dynamics of disk galaxies in general.

Solar Physics

The members of RCAAM working in solar physics possess significant skills and experience in the study and analysis of (1) magnetic loops in the solar corona, (2) particle acceleration processes in reconnecting magnetic configurations, (3) small-scale phenomena in the solar atmosphere, including micro-flares and jets, (4) solar magnetography and related diagnostics, (5) solar eruptions and their connections with the Earth, including eruption prediction, and (6) fundamental properties and complexity of solar magnetism. RCAAM solar physicists perform both data analysis and modeling, routinely analysing data from multiple ground- and space-based instruments and actively collaborating with fellow solar and heliospheric physicists worldwide.

RCAAM solar physicists are active members of multiple international professional organizations and routinely attend and contribute to International Conferences, Workshops, Symposia, as well as to Public Outreach activities aiming to inform and educate the general public on aspects of heliophysics. They participate and organize multiple conferences and convene sessions within wider conferences. They interact and collaborate with colleagues in Greece, Europe in general, the Unites States, and Asia (China, Japan).

Astrophysical Magnetohydrodynamics

We are investigating the dynamics of electrically conducting magnetized fluids in various systems of astrophysical interest. Over the years, we have developed pioneering semi analytical solutions of the non-linear equations of Magnetohydrodynamics (MHD) in non-relativistic protostellar winds, relativistic galactic and extragalactic jets, magnetized protostellar collapse, the axisymmetric pulsar magnetosphere, and the magnetosphere of rotating black holes. More recently, we have been working on a particular regime of MHD, namely Force-Free Electrodynamics (FFE), and developed a numerical code that we implement in the study of the structure and high energy radiation of the three dimensional pulsar magnetosphere and the solar corona. We are investigating accretion disk magnetic winds as the origin of Warm Absorbers (WA) and Ultra Fast Outflows (UFO) in Active Galactic Nuclei (AGN). We are also actively investigating the role of a novel astrophysical mechanism, the Cosmic Battery, in the origin of astrophysical magnetic fields and in the dynamics of X-ray binaries and astrophysical jets.

Cosmology & Gravitation

In the field of Cosmology, research ranges from observational to fully theoretical aspects of Cosmological physics. In particular RCAAM is interested in: (a) statistical properties of the large scale structures as well as the geometry and topology of the distribution of matter in the Universe, (b) constraints on the cosmological parameters from cosmological data, (c) evolution of perturbations and structure formation in different cosmological models, (d) the nature of dark energy and the possible interaction between dark matter and dark energy, (e) alternative theories (except dark energy) for the accelerated expansion of the universe, and (f) classical and quantum cosmology of scalar fields.

In the field of Gravitation, research is pursued in the following thematic areas: (a) classical problems in General Relativity, (b) alternative theories of gravity, (c) black hole physics and in particular on the computation of Hawking radiation, black hole entropy and the possible solutions of the Black Hole Information Paradox, (d) quantum fields in curved spacetime, and (e) quantum gravity phenomenology.

Scientific Projects

The scientific staff of RCAAM participated during 2021 in the following programs:

1. **“Non-linear phenomena in galactic disks”** (2018-2020, but the publications of the results of the program are continued). Program of the Research Committee of Academy of Athens (200/895). (G. Contopoulos, P.A. Patsis, C. Efthymiopoulos, University of Padova/RCAAM, M. Harsoula, K. Zouloumi. Collaboration with E. Xylouris and I. Alikakos (National Observatory of Athens). During 2021 the program funded the participation of two researchers in conferences. A request for its continuation has been submitted.
 - Publications in journals with referees: **6, 7, 8.**
 - Talks: **PP-1, PP-2, MH-1, MH-2.**
 - Observations of galactic disks have been carried out with the Aristarchos Telescope of NOA (Collaboration with E. Xylouris and I. ALikakos).
2. **“Dissemination of research results”** (2021). Program of the Research Committee of Academy of Athens (200/969) (G. Contopoulos, A.C. Tzemos, P. Patsis).
11 hybrid seminars were conducted (simultaneous conduction as webinars) at RCAAM and the publication of a special volume of Center was made (see “Publications” and the catalogue of talks in the section “Seminars”).
3. **“Study of the dynamical evolution of the entanglement and coherence in quantum systems”** (2018-2022). (G. Contopoulos, C. Efthymiopoulos, A.C. Tzemos) (non funded).
 - Publications in journals with referees: **1, 2, 3, 4, 5.**
 - Talks: **AT1, AT2, AT3, AT4, AT5.**
4. **“Orbital content of galactic bars”** (2019-2022). Program of the Laboratoire d’Astro-physique de Marseille (LAM), France, of the Aix-Marseille University in collaboration with RCAAM (E. Athanassoula, LAM, P. Patsis, S. Pastras, Y. Wang, National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China). Supports visits of the researchers for collaborations.
 - One publication in preparation.
5. **“Numerical investigation of the impact of complex instability to the phase space structure of dynamical systems with emphasis to barred galaxy models”** (2019-2022). (H. Skokos, University of Cape Town, S. Africa, P. Patsis, A. Bäcker, Technische Universität Dresden, Germany). The University of Cape Town supports the visits of H. Skokos in RCAAM.

- Publications in journals with referees: **9**.
 - Talks:**PP-3**.
6. **“N-body simulations of galactic disks - The relation between observed spiral disk morphologies and the dynamical properties of DM halos”** (2014-2024). (P. Patsis, T. Naab, Max-Planck Institut für Astrophysik, Germany, P. Grosbol, European Southern Observatory, Munich, Germany). The Max-Planck Institut für Astrophysik supports the visits of P. Patsis at Garching. Computational time (which is renewed every year) is provided in the Computational Center RZG, Garching, Germany.
 - Numerical simulations with N-body models are conducted in RZG.
 - One publication in preparation.
 7. **“Models of VHE Emission in Pulsars: Evaluation of the Current State-of-the-Art and Future Prospects”** (2019-). International group collaboration of the International Space Science Institute-ISSI Bern. Participation from RCAAM, I. Contopoulos.
 8. **Study of the Cosmic Battery with the Event Horizon Telescope”** (2021-). (I. Contopoulos, I. Myserlis (MPI Bonn and IRAM Granada)) (non funded).
 9. **Study of magnetized winds from accretion disks around Active Galactic Nuclei-AGN”** (2021-). (I. Contopoulos, D. Kazanas (NASA/Goddard)) (non funded).
 10. **Study of gravitational waves from Gamma-Ray Bursts-GRB”** (2021-). (I. Contopoulos, D. Papadopoulos (AUT)) (non funded).
 11. **“The nature of dark energy”** (2011-2018, but the publications of the results of the program are continued). (S. Basilakos, M. Pleionis (AUT), J. Sola (Un. of Barcelona), S. Capozziello (Un. of Naples), A. Lima (Un. of Sao Paulo) και N. Mavromatos (King College Un. of London). Financially supported by the universities of Barcelona, Naples and S. Paulo.
 - Publications in journals with referees: **14, 15, 16 ,17 ,18, 19, 21, 23, 28**.
 12. **“GRATOS”** (2021-). Program related to the use of Graph-theory in science. The program will be funded by the Cyprus Institute of Research with European resources (2018-2022). It is an international collaboration between the European University of Cyprus, RCAAM, NTUA and Virginia-Tech Institute (USA). The principal investigators are Dr. B. Papadopoulou and A. Efsthathiou. Representative from Greece for the application of Graph-theory in Astrophysics is S. Basilakos. Total budget: 250.000€.
 - The program has just started and there are no publications yet.

13. **“Development of the ASPIICS Coronagraph for the PROBA-3 Mission”** (2009-). Program of the European Space Agency (ESA). Principal investigator: Dr. A. Zhukov, Royal Observatory of Belgium, Βέλγιο. Principal researcher from Greece: Prof. K. Tsiganos, UOA. Participation from RCAAM, M. Georgoulis and K. Gontikakis.
 - The construction work of the instrument is in progress
14. **“Solar Orbiter Modeling and Data Analysis Working Group (MADAWG)”** (2017-). Program of the European Space Agency (ESA). Principal Researcher: Dr. A. Rouillard, Insitute of Research in Astrophysics and Planetology (IRAP), Toulouse, France. Participation from RCAAM, M. Georgoulis.
 - Two publications in preparation.
15. **“ESA / SSA SWE Solar Weather Expert Service Center (ESC)”** (2017-2023). Sponsor: European Space Agency Space Situational Awareness Programme (ESA/SSA). Total budget (for the Academy of Athens): 159.000€. Program Code of the Research Committee: 200/902. Principal Researcher: Dr. J. Andries, Royal Observatory of Belgium. Participation from RCAAM, M. Georgoulis. Software Engineer: D. Mygdakos.
 - The operation of this service at RCAAM continues.
16. **“GSU Contributions to the Development of Forecasting Capabilities for the NASA SRAG”** (2019-2020). Program of the NASA Solar Radiation Analysis Group (SRAG). Sponsor : NASA. Total budget: 800.000\$. Principal researcher: Dr. R. A. Angryk, GSU Computer Science Dept. Participation from RCAAM, M. Georgoulis.
 - Publications in conference proceedings with referees: **1**.
17. **“Elements: Comprehensive Time Series Data Analysis for the Prediction of Solar Flares and Eruptions”** (2019-2022). Sponsor: National Science Foundation. Total budget: 600.000\$. Principal researcherg: Dr. R. A. Angryk, GSU Computer Science Dept. Participation from RCAAM, M. Georgoulis.
 - Publications in journals with referees: **29, 31**.
18. **“Space Weather Awareness Training Network (SWATNET)”** (2021-2025). Sponsor: European Union, Horizon 2020 Programme, National Science Foundation. Total budget: 3.128.225€ (486.035€ for the Academy of Athens). Principal researcher: Dr. E. Kilpua, University of Helsinki, Finland. Participation from RCAAM, M. Georgoulis.
 - Supervision of two PhD theses (see section of PhDs and Masters”).

19. **“EUVST Student Collaboration”** (2021-2026). Program funded by NASA. Total budget: 500.000\$. Principal Investigators: B. de Pontieu, Lockheed Martin Solar & Astrophysical Laboratory, USA. Participation from RCAAM, M. Georgoulis.
 - Coordination of student participation in the Solar-C mission of JAXA/NASA.
20. **“Elements: Spatiotemporal Analysis of Magnetic Polarity Inversion Lines (STEAMPIL)”** (2021-2024). Sponsor: National Science Foundation. Total budget: 600.000\$. Principal investigator: B. Aydin, Georgia State University, USA. Participation from RCAAM, M. Georgoulis.
 - The program started in 2021 and there are no publications yet.
21. **“Machine Learning-based Solar Energetic Particle Event Prediction Using X-ray, Proton and Electron Flux Data”** (2021-2024). Sponsor: NASA. Total budget: 133.000\$. Επιστημονικός Υπεύθυνος: P. Martens, Georgia State University, USA. Participation from RCAAM, M. Georgoulis.
 - The program started in 2021 and there are no publications yet.
22. **“Operationalizing Data-Driven Prediction Tools for Post-Eruption Solar Energetic Particles”** (2021-2023). Sponsor: NASA. Total budget: 494.000\$. Principal investigator: P. Martens, Georgia State University. Participation from RCAAM, M. Georgoulis.
 - The program has just started and there are no publications yet.
23. **“Step Forward in Solar Flare and Coronal Mass Ejection (CME) Forecasting”** (2021-2024). Program of the International Space Science Institute (ISSI) – Beijing, China. Επιστημονικός Υπεύθυνος: F. Zuccarello, University of Catania, Ιταλία. Participation from RCAAM, M. Georgoulis.
 - The program started in 2021 and there are no publications yet.
24. **“Machine Learning for Solar Energetic Particle (SEP) Event Forecasting”** (2020-). Program of NASA. Principal researcher: Dr. I. Kitiashvili, NASA Ames Space Flight Center. Participation from RCAAM, M. Georgoulis.
 - There are no results yet.
25. **“Marie Curie Innovative Training Network Stardust-R: The asteroid and Space Debris Network v2.0”** (2019-2022). International research program funded by the European Union in the framework of Horizon- 2020 action. Total budget: 221.000€ (for the Academy of Athens, until 2022, 196.000€). Participation from RCAAM, C. Efthymiopoulos University of Padova/RCAAM and M. Har-soula.

- Supervision of a PhD student from abroad (E. Legnaro), for 3 years (September 2019), with supervisor C. Efthymiopoulos and co-supervisor M. Harsoula.

Construction of experimental station for the measurement of Schumann waves and preliminary measurements”

26. **“Support of the operation and the development of international station for the study of Schumann electromagnetic waves”** (2021-2023). Program of the research committee of the Academy of Athens (200/978). Principal investigator: V. Tritakis. Participation from RCAAM, I. Contopoulos. Collaboration with the university of Krakow, Poland.

- The Schumann wave measuring station located at the top of Mount Parnos in Laconia was maintained and supervised.
- Publications in journals with referees: **12, 13.**

Moreover, the research director of RCAAM and as director of the Institute of Astronomy, Astrophysics, Space Applications and Remote Sensing of the National Observatory of Athens, Basilakos participated in the following programs:

1. **“ScyLight: European Space Agency”**. Program for the development of broadband network at Helmos Observatory in the framework of the corresponding program of ESA. Total budget: 1.000.000€.
2. **“ESPA of Peloponnisos”**. Program for the dissemination of Astronomy through the Observatory of Kryoneri”. Total budget: 362.000€.
3. **“Proteas”** (2018-2021). Program for the support of research. Principal investigator: S. Basilakos. Total budget: 840.000€.

Publications in 2021

Special Editions

1. RCAAM published a special volume (in Greek) with title “Advances in Astronomy 2020” (Eds., G. Contopoulos and P.A. Patsis), which includes a series of papers summarizing the recent research results of RCAAM (ISSN: 2585-3767).
-Moreover Dr. Patsis was the editor for the publication of the full report of RCAAM for 2020 in a special issue
2. Dr. Georgoulis was editor of the special volume “Space Weather Research Across the Full Data Lifecycle” (Eds. R. M. McGranaghan, A. Anastasiadis, E.

Camporeale and M. K. Georgoulis), *J. Space Weather Space Climate*, Vol. 11, 2021.

Moreover, Dr. Georgoulis worked on the preparation of the special volume "Helicities in Geophysics, Astrophysics and Beyond" (Eds. Kuzanyan K., Yokoi N., Georgoulis M. K. and Stepanov R., 2021, AGU Monograph Series, Wiley, that is going to be published in 2022.

3. Finally, Mr. M. Katsanikas edited the publication of the special volume "Chaos Indicators, Phase Space and Chemical Reaction Dynamics", of the journal *Physica D*, which is in press and going to be published in 2022.

Publications in International Journals with Referees

(Published or accepted for publication in 2021 (35 papers in total))

1. Tzemos A.C. and Contopoulos G., 2021, "Ergodicity and Born's rule in an entangled 3- qubit Bohmian system", *Phys. Rev. E*, 104, 054211.
2. Tzemos A.C. and Contopoulos G., 2021, "The role of chaotic and ordered trajectories in establishing Born's rule", *Phys. Scr.*, 96, 065209.
3. Tzemos A.C. and Contopoulos G., 2021, "Order and chaos in time periodic Hamiltonian systems", *Phys. D*, 419, 132847.
4. Tzemos A.C. and Contopoulos G., 2021, "Integrals of motion in time periodic Hamiltonian systems: The case of the Mathieu equation", *Regul. Chaotic Dyn.*, 26, 89.
5. Tzemos A.C. and Contopoulos G., 2021, "Chaos and ergodicity in entangled non-ideal Bohmian qubits", *Chaos Solit. Fractals*, (in press).
6. Harsoula M., Zouloumi K., Efthymiopoulos C. and Contopoulos G., 2021, "Precessing ellipses as the building blocks of spiral arms", *Astron. Astrophys.*, 655, A55.
7. Patsis P.A., Xilouris E.M., Alikakos J. and Athanassoula E., 2021, "Edge-on boxes with X-features as parts of galactic bars. NGC 352: A direct piece of observational evidence", *Astron. Astrophys.*, 647, id.A20.
8. Patsis P. A., Manos T., Chaves-Velasquez L., Skokos Ch. et al., 2021, "Chaoticity in the vicinity of complex unstable periodic orbits in galactic type potentials", *Physica D*, (in press), arXiv:2109.09656.
9. Manos T., Skokos Ch. and Patsis P. A., 2021, "Orbit volution in growing stellar bars: bar-supporting orbits at the vertical ILR region", *Mon. Not. R. Astron. Soc.*, (in press), arXiv:2109.00514.

10. Contopoulos I., Strantzalis A., Papadopoulos D. and Kazanas D., 2021, "Gravitational waves from GRB core spin-down", *Mon. Not. R. Astron. Soc.* (in press).
11. Myserlis I. and Contopoulos I., 2021, "An underlying universal pattern in Galaxy halo magnetic fields", *Astron. Astrophys.*, 649, 94.
12. Florios K., Contopoulos I., Tatsis G., Christofillakis V. et al. (including Tritakis V.), 2021, "Possible earthquake forecasting in a narrow space-time-magnitude window", *Earth Sci. Inform.*, 14, 349.
13. Tritakis V., Contopoulos C., Florios G., Tatsis V. et al., 2021, "Anthropogenic noise and its footprint on ELF Schumann resonance recordings", *Front. Earth Sci.*, 9, 163.
14. Saridakis E. and Basilakos S., 2021, "The generalized second law of thermodynamics with Barrow entropy", *European Phys. J. C*, 81, 644.
15. Anagnostopoulos F., Basilakos S. and Saridakis E., 2021, "Observational constraints on Myrzakulov gravity", *Phys. Rev. D.*, 103, 4013.
16. Anagnostopoulos F., Basilakos S. and Saridakis E., 2021, "First evidence that non-metricity $f(Q)$ gravity could challenge Λ CDM", *Phys. Lett. B.*, 822, 36634.
17. Barrow J. D., Basilakos S. and Saridakis E., 2021, "Big Bang Nucleosynthesis constraints on Barrow entropy", *Phys. Lett. B.*, 815, 36314.
18. Lympers A., Basilakos S. and Saridakis E., 2021, "Modified cosmology through Kaniadakis horizon entropy", *European Phys. J. C*, 81, 1037.
19. Tsiapi P., Basilakos S., Plionis M., Terlevich R. et al., 2021, "Cosmological constraints using the newest VLT-KMOS H II galaxies and the full Planck CMB spectrum", 2021, *Mon. Not. R. Astron. Soc.*, 506, 5039.
20. Adkikary P., Das S., Basilakos S. and Saridakis E., 2021, "Barrow Holographic Dark Energy in non-flat Universe ", *Phys. Rev. D.*, 104, 3519.
21. Kapsabelis E., Triantafillopoulos A., Basilakos S. and Stavrinos P.C., 2021, "Applications of the Schwarzschild-Finsler-Randers model", *European Phys. J. C*, 81, 990.
22. Khylllep W., Dutta J., Basilakos S. and Saridakis E., 2021, "Background evolution and growth of structures in interacting dark energy scenarios through dynamical system analysis", *Phys. Rev. D* (in press).
23. Valelis C., Anagnostopoulos F., Basilakos S. and Saridakis E., 2021, "Building healthy Lagrangian theories with machine learning", *Inter. J. Mod. Phys. D.*, 305, 0085.

24. Di Valentino E., Anchordoqui L. A., Akarsu O., Ali-Haimoud Y. et al. (including Basilakos S.), 2021, "Cosmology intertwined I: Perspectives for the next decade", *Astrop. Phys.*, 1310, 2607.
25. Di Valentino E., Anchordoqui L. A., Akarsu O., Ali-Haimoud Y. et al. (including Basilakos S.), 2021, "Cosmology intertwined II: The hubble constant tension", 2021, *Astrop. Phys.*, 131, 102605.
26. Di Valentino E., Anchordoqui L. A., Akarsu O., Ali-Haimoud Y. et al. (including Basilakos S.), 2021, "Cosmology intertwined III: σ_8 and S_8 ", 2021, *Astrop. Phys.*, 131, 102604.
27. Di Valentino E., Anchordoqui L. A., Akarsu O., Ali-Haimoud Y. et al. (including Basilakos S.), 2021, "Cosmology intertwined IV: The age of the Universe and its curvature", 2021, *Astrop. Phys.*, 131, 102607.
28. Gonzalez-Moran A. L., Chavez R., Terlevich E., Terlevich R. et al. (including Basilakos S.), 2021, "Independent cosmological constraints from high-z H II galaxies: new results from VLT-KMOS data", 2021, *Mon. Not. R. Astron. Soc.*, 505, 1441.
29. Georgoulis M.K., Bloomfield D.S., Piana M., Massone A.M. et al. (including Gontikakis C.), 2021, "The flare likelihood and region eruption forecasting (FLARECAST) project: flare forecasting in the big data & machine learning era", *JSWC*, 11, 39.
30. Thalmann J., Georgoulis M.K., Liu Y., Pariat E. et al., 2021, "Magnetic helicity estimations in models and observations of the solar magnetic field. Part IV. Application to solar observations", *Astrophys. J.*, 922, 41.
31. Ahmadzadeh A., Aydin B., Georgoulis M.K., Kempton D. et al., 2021, "How to train your flare prediction model: Revisiting robust sampling of rare events", *Astrophys. J. Suppl.*, 254, 23.
32. Samara E., Patsourakos S. and Georgoulis M.K., 2021, "A readily implemented atmosphere sustainability constraint for terrestrial exoplanets orbiting magnetically active stars", *Astrophys. J. Lett.*, 909, L12.
33. Xaplanteris L., Livada M., Mavromichalaki H., Dorman L. et al. (including Georgoulis M.K.), 2021, "Improvements in the coupling function between primary and ground level cosmic ray particles based on neutron monitor data", *Solar Phys.*, 296, 91.
34. Katsanikas M., Aguilar Sanjuan B., Gonzalez Montoya F., Garcia-Garrido V.J. et al., 2021, "Bifurcation study on a degenerate double van der Waals Cirque potential energy surface using Lagrangian descriptors", *Commun. Nonlinear Sci. Numer. Simulat.*, 105, 106089.

35. Agaoglou M., Katsanikas M. and Wiggins S., 2021, "The influence of a parameter that controls the asymmetry of a potential energy surface with an entrance channel and two potential wells", Regul. Chaotic Dyn., 27, (in press).

Publications in conference proceedings and other publications with referees:

1. Ji A., Arya A., Kempton D., Angryk R. et al. (including Georgoulis M.K.), 2021, "All-clear solar energetic particle event prediction: Methods and implementation", IEEE International Conference on Cognitive Machine Intelligence, (in press).

Publications in Greek

1. G. Contopoulos: "Science as a value", Aktines, 2020.
2. G. Contopoulos: "Order, Chaos and Randomness", Aktines, 2020.
3. S. Vasilakos: "New perspectives for the Xelmos Observatory in the program ScyLight: European Space Agency".
4. V. Tritakis: "Fourth Industrial or Digital Revolution". Newspaper "ΠΑΛΜΟΣ" (4 issues).
5. V. Tritakis: "200 years from 1821". Newspaper "ΠΑΛΜΟΣ" (2 issues).

The contents of the special volume of RCAAM "Advances in Astronomy 2020" are:

1. G. Contopoulos: Integrals of Dynamical Astronomy
2. G. Contopoulos and I. Contopoulos: Search for extraterrestrial life.
3. G. Contopoulos and A.C. Tzemos: Orbits and integrals of motion in time periodic Hamiltonian systems.
4. P. Patsis: The structure and the evolution of Galaxy.
5. M. Georgoulis: Solar weather forecast with artificial intelligence.
6. S. Basilakos: The changing vacuum energy as a mechanism for understanding the cosmic history of the universe.
7. C. Gontikakis and S. Pastras: Solar Physics: Study of Ultraviolet Scattering radiation in the transition region of an active center.
8. E. Athanasiou and C. Gontikakis: Study of the loops of an active center and analysis of the geometry.
9. M. Harsoula, G. Contopoulos and K. Zouloumi: Spiral waves in galactic models.
10. V. Tritakis: Stations for recording, archiving and studying electromagnetic radiation of very low frequency (ELF), especially in the Schumann spectral range ($0 - 50\text{Hz}$), in the Greek area.

Distinctions

Mr. S. Vasilakos in 2021 was proclaimed with the no. 159/2020 unanimous decision of the Municipal Council of Kalavrita Honorary Citizen of the city of Kalavrita, as a sign of recognition of the efforts made as Director of IAADET for the development of the Telescope "Aristarchos" of EAA located within the administrative boundaries of the municipality of Kalavrita.

Participation in Conferences and Talks

P. Patsis

- PP-1. "European Astronomical Society Annual Meeting", Leiden, Netherlands, Ολλανδία, June 28 - July 4. Poster with title "Orbital evolution in the Galactic bulge, in time-independent and time-dependent models" (virtual).
- PP-2. "The 15th Hellenic Astronomical Conference", Patras, July 5-8. Talk with title: "Orbital patterns supporting X-shaped galactic bulges" (virtual).
- PP-3. "27th Summer School on Dynamical Systems and Complexity", NCSR Demokritos, 19-24 of July, invited talk with title: "The structure of the phase space in 3-d galactic systems" (virtual).

I. Contopoulos

- IC-1. "Polarized Radiation near Supermassive Black Holes", Princeton Center for Theoretical Science, May 10-13 (virtual).
- IC-2. "Neutron stars as multi-messenger laboratories for dense matter", ECT (European Centre for Theoretical Studies in Nuclear Physics and related areas), June 14-17 (virtual).
- IC-3. "Recent Developments in Gravity", NEB-19 Virtual Conference, September 20-23 (virtual).
- IC-4. "The 15th Hellenic Astronomical Conference", Patras, July 5-8 (virtual).
- IC-5. "From Vision to Instrument: Designing the Next-Generation EHT to Transform Black Hole Science", ngEHT Virtual Meeting, November 1-5 (virtual).

S. Vasilakos

- SV-1. "The stubborn inconstancy of constants. A meeting in memory of John D Barrow, FRS", meeting in Cosmology and Gravity, November 12 in the memory

of the Prof. J.D. Barrow (Cambridge University). Πρόσκληση από την Royal Astronomical Society (UK) with 7 more distinguished cosmologists. Talk with title: "Varying gravitational constant G in the context of modified gravity models" (virtual).

SV-2. "International Conference in Gravity NEB", Athens, September 2021. Invited talk with title: "Modified gravity models in the context of Cosmology".

SV-3. International conference "Emerging trends in Gravitation and Cosmology", Department of Mathematics of the Presidential University of India. December 2021. Invited talk with title: "Modified gravity and Cosmology" (virtual).

M. Georgoulis

MG-1. "43 rd COSPAR Scientific Assembly", Sydney, Australia, January 28 – February 4. Two talks with title: "Properties Determining Eruption Initiation and Planeto-Effectiveness of Eruptive Transients in Magnetically Active Stars" and "Data Benchmarking for Solar Flare, CME and SEP Event Forecasting: Different Prediction and Verification Needs, Unified" (virtual).

MG-2. "Parker Solar Probe Switchback Workshop", The Johns Hopkins University APL, Maryland, ΗΠΑ, March 5 (virtual).

MG-3. "Quo Vadis European Space Weather Community", webinar, March 17 (participation).

MG-4. "Vector Magnetic Fields: Progress and Prospects", 2021 SDO Science Workshops, NASA/Goddard Space Flight Center, USA ΗΠΑ, March 25. Invited talk with title: "Prediction of Solar Events Using Vector Magnetograms and Machine Learning" (virtual).

MG-5. "Applications of Statistical Methods and Machine Learning in the Space Sciences, Space Science Institute, Boulder, CO, USA, May 17 – 21. Invited talk with title "Machine Learning Methods for the Forecasting of Solar Eruption Products" (virtual).

MG-6. "238th Meeting of the American Astronomical Society", June 7 – 9. Announcement with title: "Verification of a practical magnetic helicity budget calculation and its contribution to axial field estimates of solar and stellar CMEs" (virtual).

MG-7. "The 15th Hellenic Astronomical Conference", Patras, July 5-8. Invited talks with title: "COSPAR Athens 2022: The Time of Athens" and "Solar Flare Forecasting: a Brief How-To, Including Progress and Challenges" (virtual).

- MG-8. "16th European Solar Physics Meeting (ESPM-16)", Turin, Italy, September 6 – 10. Presentation with title: "An Overview of the European Union FLARECAST Project: Where Do We Stand and Potential Future Directions of Research" (virtual).
- MG-9. "COSPAR ISWAT Virtual Meeting Plenary", September 13. Participation in creating road maps of the Panel on Space Weather της COSPAR (virtual).
- MG-10. "17th European Space Weather Week (ESWW-17)", Glasgow, UK, October 25 – 29. Two talks with title: "An Emerging Pattern in Solar Eruption Initiation and Quantitative, Near-Realtime Assessment Diagnostics" and "Data Benchmarking and Resulting Comparison- and Interpretation-Driven Performance Verification" (virtual).

Moreover, Dr. **Georgoulis** made the virtual presentations

- MF-11. "Space Weather Forecasting: a Textbook Case of Research to Operations", Department of Physics and Astronomy, Georgia state University, April 19.
- MF-12. "The Science of FLARECAST: Results, Open-Access Resources and Envisioned Future Trends in Solar Flare Forecasting", University of Sheffield, UK, July 2.
- MF-13. "Solar / Stellar Eruptions and Planetary Forcing: a First-Principles, Unifying Approach", University of Gratz, Αυστρία, July 7.
- MF-14. "Solar Weather Forecasting: A Research-to-Operations-to-Research Approach", in the Monthly Research Colloquia of ASI series of the Italian Space Administration, September 27.
- MF-15. "Some Thoughts on a SEP Event All Clear Definition and Implementation", as a member of the NASA Machine Learning for SEP Event Forecasting, November 3.
- MF-16. "Solar eruptions: from understanding to forecasting", University of Patras, December 13.

C. Gontikakis

- CG-1. "The 15th Hellenic Astronomical Conference", Patras, July 5-8. Talk with title: "Study of the solar transition region using IRIS observations of a solar flare" (with S. Antiochos) Posters with title: " Studying the temporal evolution of a solar flare observed with IRIS in the UV" (with O. Stamatakis),
- CG-2. "Study of the inclination of transition region loops observed with IRIS" (μαζί με Σ. Αθανασίου) and "A study on the scattering of ultraviolet radiation in a solar active region" (with S. Pastras).

M. Harsoula

- MH-1. "The 15th Hellenic Astronomical Conference", Patras, July 5-8. Talk with title: "The building blocks of the spiral arms in galaxies".
- MH-2. "European Astronomical Society Annual Meeting", Leiden, Netherlands, June 28 - July 4. Poster with title: "The building blocks of the spiral arms in galaxies".

M. Katsanikas

- MK-1. "Successful dynamical system applications in nonlinear sciences", 11th symposium of the second web conference in Nonlinear Dynamics and Complexity ISEP, Porto, October 4-6. Talk with title "Phase space and Dynamics in a caldera potential energy surface" (virtual).

A. Tzemos

- AT-1. "Maple Virtual Conference 2021", Waterloo, Canada, November 2-5). Talk with title: "Quantum Trajectories: An overview with Maple" (virtual).
- AT-2. "Quantum Thermodynamics Conference", University of Geneva , October 4-8. Poster with title: "Ergodicity and Born's Rule in entangled Bohmian Qubits".
- AT-3. "Vienna Quantum Foundations Conference", Austrian Academy of Sciences, September 7-10. Talk with title: "Born's rule in the case of two entangled Bohmian qubits" (virtual).
- AT-4. '27th Summer School on Dynamical Systems and Complexity", NCSR Demokritos, 19-24 of July. Talk with title: "Born's rule in the case of two entangled Bohmian qubits" (virtual).
- AT-5. " Virtual Bristol Quantum Information Technologies Workshop", University of Bristol, April 26-28. Poster with title: "Order and chaos in two entangled Bohmian qubits" (virtual).
- AT-6. " 6th International Conference for Young Quantum Information Scientists", University of Michigan Πανεπιστήμιο Michigan, April 12-16. Talk with title: "Born's rule in the case of two entangled Bohmian qubits" (virtual).

Organisation of Conferences and Meetings

1. IK-1 Dr. I. Contopoulos was

- Coordinator of the International group of the International Space Science Institute-ISSI Bern with title “Models of VHE Emission in Pulsars: Evaluation of the Current State-of-the-Art and Future Prospects”
<http://www.issibern.ch/teams/vheemission/index.php/team/>.

2. MG-1. Dr. M. Georgoulis was

- Member of the scientific organizing committee of a meeting with title: Driving Solar Eruptions, 43 rd COSPAR Scientific Assembly, Sydney, Australia, January 28 – February 4 2021 (virtual).
- Member of the scientific committee, Applications of Statistical Methods and Machine Learning in the Space Sciences, Space Science Institute, Boulder, CO, USA, May 17 – 21 (virtual).
- Member of the scientific committee, 16th European Solar Physics Meeting (ESPM-16), Turin, Italy, September 6 – 10 2021 (virtual).
- Member of the scientific committee, 1st School in the framework of the European Program SWATNET with title: “Introduction to Space Weather”, November 8 – 12 2021.
- Member of the scientific committee “Online Advanced Study Program on Helicities in Astrophysics and Beyond” , 2020 – 2021.

Seminars

RCAAM, aiming at the continuous effort to inform both researchers and postgraduate students in modern research, organizes weekly seminars, funded mainly by the Academy of Athens, by decision of its Council, while some researchers of foreign institutions were funded by their institutions to come and speak in the seminars. In 2021 only 11 seminars-webinars took place at RCAAM, due to the COVID-19 pandemic, most of them about Astronomy, Astrophysics and Mechanics.

The invited speakers were, besides the researchers and students of RCAAM, Academicians, professors and distinguished scientists from various universities and research centers in Greece and abroad. Here is the complete list of the seminars.

Invited Talks 2021

Constantinos Gontikakis RCAAM of the Academy of Athens	Study of the emission measure during a solar flare observed with IRIS spectrograph	22/4/2021
Athanasios Tzemos RCAAM of the Academy of Athens	Born's Rule in the case of two entangled Bohmian qubits	13/5/2021
Christos Efthymiopoulos University of Padova	Secular dynamics for exoplanetary systems with two planets in mutually inclined orbits	1/6/2021
George Contopoulos Academy of Athens	A short review of the Philosophy of Physics and Mathematics	8/6/2021
Panos Patsis RCAAM of the Academy of Athens	Building blocks of 3D, X-shaped bulges and thick spirals	24/6/2021
Dimitrios Christodoulou University of Massachusetts	Major-Body Clustering in the Solar System	13/7/2021
Dimosthenis Kazanas NASA	Gravity beyond Einstein? Yes, but in which direction?	26/10/2021

Invited Talks 2021

Dimitri Gadotti ESO	Nuclear discs in external galaxies and the Milky Way: building "bulges" without mergers	9/11/2021
Edoardo Legnaro AUT	Analytic Theory for Secular Lunisolar Resonances	30/11/2021
Ivan Minchev Leibniz-Institut für Astrophysik	Modeling the Galactic disk in the age of Gaia	7/12/2021
Thorsten Naab Max-Planck-Institute for Astrophysics	The GRIFFIN project - towards realistic simulations of galactic star cluster populations	14/12/2021

Teaching

Researchers of RCAAM taught postgraduate courses in university departments, seminars for students and researchers, and schools organized by scientific associations.

- **Dr. Patsis** made a series of 7 seminars for the students of RCAAM in "Galactic Dynamics".
- **Dr. Basilakos** taught the lesson of Cosmology in the Mathematics and Physics Departments of UOA.
- **Dr. Gontikakis** participated in the teaching of the course of Solar Physics in the 3rd year of the Physics Department of the University of Athens, in collaboration with Prof. G. Dagleis, Dr. A. Cheilaris, Dr. Chr. Katsavrias during the winter semester (October -June-December) of the Academic year 2021-2022.

Phds and Masters

RCAAM researchers participate in other PhD supervision committees inside and outside of RCAAM. Specifically, during 2020 RCAAM members supervised the PhD of:

- Dr. Patsis is co-supervisor of the PhD thesis of Magdalini Aggelakopoulou with title "Numerical and theoretical study of 3-d Hamiltonian systems in Finance" (Department of Financial Studies, University of Thessaly). He is also the supervisor of the M.Sc. thesis of S. Pastras (University of Athens) with title: "Comparing hydrodynamics codes for modeling the gas flow in barred spiral galaxies".

- Dr. Contopoulos supervised the PhD thesis of E. Coutsantoniou with title “Study of radiation of the accretion discs around black holes”. He is also member of the advisory committee of the PhD thesis of X. Sinnis (UOA) with title “Study of the stability of relativistic magnetised astrophysical jets” and of the PhD thesis of V. Bisketzis (UOA) with title “Plasma Dynamics in the environment of a rotating black hole”. Finally he supervises the thesis of the postgraduate student V. Spyrou (UOA) with title “Magnetized accretion disks which produce winds” and the thesis of A. Dogas (UOA) with title “New method of using current sheets in the ideal MHD”.

- Dr. Vasilakos supervises the PhD thesis of Ioannis Papagiannopoulos at the University of Athens with title “Study of symmetries in cosmological models of alternative gravity”. Moreover he supervises the Phd thesis of Fotios Anagnostopoulos (UOA) with title “Study of the accelerating expansion rate of the Universe” and the PhD thesis of Pavlina Tsiapi (NTUA) with title “Study of the dark energy via cosmological microwave radiation from Planck”

Finally, Dr. Vasilakos is member in the advisory board of the Phd thesis of A. Papageorgiou (AUTH) with title “Cosmological parameters and dark energy”, A. Triantafyllopoulos (UOA) with title “Finsler geometries and cosmological extensions” and G. Gakis (NTUA) with title “Generalized theories of gravity in the tangent bundle”.

- Dr. Georgoulis was member the advisory board of the Phd thesis of Loukas Xaplanteris at the Department of Physics in UOA with title “Coupling between primary and secondary cosmic radiation coming from galaxies and the sun”. Dr. Georgoulis is member of the board of the Phd thesis of Evangellia Samara, Department of Mathematics of the Katholieke Universiteit Leuven, Belgium, with title “Improved Model for Solar Wind Prediction Including Solar and Stellar Coronal Mass Ejection”.

Dr. Georgoulis is also a member of the Advisory Committee of the thesis of the PhD candidate Aparna Venkataramanasastry in the Department of Physics and Astronomy of Georgia State University, USA, with the indicative title “Space Weather and Solar Flare Prediction”. He was a member of the Advisory Committee of the doctoral dissertation of the doctoral candidate Azim Ahmadzadeh in the Department of Computer Science of Georgia State University, USA, with the indicative title “Machine Learning of Scientific Events: Detection, Classification and Segmentation”.

He is also a member of the Advisory Committee for the candidate’s doctoral dissertation Dr. Sumanth Rotti, Department of Physics and Astronomy, Georgia State University, USA, with the indicative title ‘Solar Energetic Particle (SEP) Event Forecasting Using Machine Learning”.

He is also a member of the Advisory Committee for the candidate’s doctoral dissertation Augustin André-Hoffmann Department of Physics University of

Ioannina “Pre-Eruption Magnetic Configuration and Eruption Forecasting”.

He is also a member of the Advisory Committee for the candidate’s doctoral dissertation Shifana Koya Department of Physics University of Ioannina with title “Assessment of the Near-Sun CME Magnetic Field”

In addition he has an advisory role in the work of doctoral candidates Varun Chaturmutha (supervisor: Prof. S. Jefferies, GSU Physics & Astronomy), Varun Chaturmutha (Supervisors: Prof. S. Jefferies, GSU Physics & Astronomy), Maxwell Hostetter, Annie Ji (supervisor: Prof. R. Angryk, GSU Computer Science) and the postgraduate student Xumin Cai (supervisor: Prof. R. Angryk, GSU Computer Science).

Finally he is the supervisor of the BSc. thesis of A. Pantazis (UOA) with title: “Forecast of solar flares”.

- Dr. Gontikakis is the supervisor of the Phd thesis of M. Koletti with title: “Study of the outflow from solar atmosphere”.
- Dr. Harsoula is member of advisory board of the PhD thesis of Constantina Zouloumi with title “Manifold theory of the spires and multiple pattern speeds in simulations of N-body discs” (supervisor C. Efthymiopoulos) and of the PhD thesis of Edoardo Legnaro with title “Orbital dynamics and diffusion to the resonance in the close space environment (supervisor C. Efthymiopoulos).
- Finally Dr. **M.Katsanikas** supervises the BSc. thesis of A. Kontogeorgou (Department of Physics University of Athens) with title: “Orbital study of the 2-d potential of a rotating bar”.

1. **M. Georgoulis**

- (a) Georgia State University: Visiting Professor until June 2020. Reporting seminar at the end of the term entitled: “Visiting GSU’s Physics and Astronomy Department for the Academic Years 2019, 2020: An Account of Activities”.
- (b) Center for Astrophysics, Harvard University: March 2 2020. Seminar with title: “An investigation on Stellar Magnetic Forcing in Planets: Lessons for Earth, Mars, and Some known Exoplanets”.

Participation in Committees

The members of RCAAM are active members in many national and international scientific committees for the promotion of researchers and university professors in Greece and abroad. They serve also as referees in the main research astronomical journals.

Promotion of Astronomy and Public Outreach

The researchers of RCAAM were invited to give lectures in educational institutions and events for the public. They also wrote articles for the public while their interventions helped to disseminate the research results of the Centre.

- **P. Patsis** Invited talk at Arsakeio-Tositseio High School of Ekali with title “Man’s position in the Universe” (virtual talk).
- **S. Basilakos** Presentation in newsbomb.gr with title: “Aristarchos: From Neraidoraxi to the space, the telescope that solves the mysteries of the universe”. Over than 15 interviews in daily and electronic press (ERT, MEGA, OPEN, KATHIMERINI, VIMA etc.)
- **M. Georgoulis** Article with title: “ Colonization of Mars: Realistic Possibility or Chimera? ” U Huffington Post Greece, March 6.
Coverage by electronic press (April 23 and 25) “ Evangelia Samara: from “ Apollo 11 ” in Royal Belgian Observatory ”, article in the “Enimerosi of Peloponnisos” (23/05) and the Huffington Post (25/05) relative to the progress of the post-graduate student of Mr. Georgoulis, Mrs. Evangelia Samaras.
4 guest in web and radio shows.
- **V. Tritakis**
Invited talk “Climate change. Many Questions”. Etaireia Filwn Laou (November).