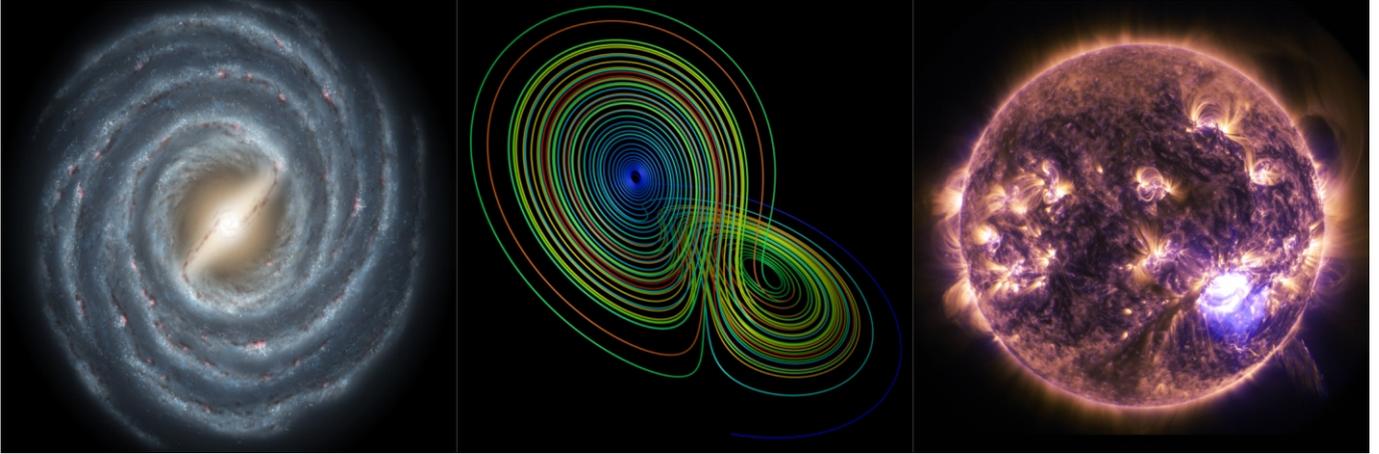


**Research Center for Astronomy
and Applied Mathematics**
of the Academy of Athens



Annual Report 2015



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Staff Members in 2015

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MSc students

Katerina Dima (Supervisor: P. Patsis)
Maria-Eirini Xrysafeli (Supervisor: P. Patsis)

Collaborators:

Georgia Aggelopoulou, Administrative support in the A-EFFort program (in collaboration with M. Georgoulis), Evaggelos Argoudelis, Financial and legal manager of the European program FLARECAST (in collaboration with M. Georgoulis), Margarita Magiati, Software development in the A-EFFort program (in collaboration with M. Georgoulis), Achilleas Strantzalis, PhD candidate (in collaboration with I. Contopoulos in the Aristeia program)

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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 2009-13 include the study of the role of Chaos in supporting structures in N-body simulations, the Dynamics of the Milky Way and other galaxies, 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. During 2013 six (6) PhD and one (1) MSc thesis were supervised by RCAAM members. The work for these seven theses has been done in RCAAM under the supervision of RCAAM members on a daily basis. The researchers of our institute participate in five (5) more supervising committees of PhD theses. RCAAM participated in the teaching of the courses "Cosmology" and "Galactic and Extragalactic Astronomy" 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

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.).

During 2013 the research of Nonlinear Dynamics at RCAAM focused on the structure of phase-space in 2D and 3D Hamiltonian systems by means of numerical and analytical techniques. Using computer-algebraic algorithms developed in our center, it was possible to exploit the tools of canonical perturbation theory, namely the construction of high order resonant normal forms. It thus became possible to study the rate of chaotic diffusion in the resonance web of 3D systems. We also produced a visualization of the phenomenon of Arnold diffusion, and we gave particular applications of these methods in concrete problems of solar and extrasolar system dynamics. There is an ongoing collaboration with the La Plata University on the subject.

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.

Currently we study the stellar and gaseous flows in galactic disks, the photometry and the dynamics of young clusters in the spiral arms of galaxies, dynamical mechanisms acting on bar-spiral systems, the diffusion and escapes of orbits away from the equatorial plane of disk galaxies, the role of supermassive black holes in the centers of galaxies for their global dynamics, as well as various codes for N-body simulations.

In our research we collaborate with colleagues at the European Southern Observatory (ESO), Germany, the Max Planck Institute for Astrophysics, Germany, the University Observatory of Munich, the University Observatory of Strasbourg, France, and the Southwest Research Institute, Colorado, USA.

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 analyzing 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 United States, and Asia (China, Japan). Several of these colleagues are, at times, invited to visit RCAAM and deliver seminars and lectures. Moreover, RCAAM solar physicists are in continual pursuit of competitive research funding. As a result, RCAAM is a member institution of (1) NASA's Solar Dynamics Observatory Feature Finding Team (SDO/FFT) consortium that provides advanced tools of automatic, real-time solar data analysis, (2) ESA's PROBA-3 mission, as science Co-Investigators of the mission's SPIICS coronagraph, and (3) the Hellenic National Network of Space-Weather Research, a THALES project funded by the Greek General Secretariat of Science and Technology. The RCAAM currently manages a Marie Curie grant on solar physics sponsored by the European Commission. Further, during 2013, RCAAM has been the Prime Contractor of an ESA Space Situational Awareness (SSA) Contract. A member of RCAAM is Greece's National Delegate to ESA's Science Programme Committee (SPC), Vice-President of the European Solar Physics Division (ESPD) of the European Physical Society (EPS), and a member of the Greek National Committee for Astronomy (GNCA).

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. We have active collaborations with NASA/Goddard (USA), the Aristotle University of Thessaloniki, University College Cork (Ireland), and the University of Crete. Our work is supported by the General Secretariat for Research and Technology with a grant "ARISTEIA" and the European Social Fund.

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.

During 2013 we have been collaborating with the following Institutes: University of Cambridge (UK), INAOE (Mexico), University of Barcelona (Spain), University of Sao Paulo (Brasil), University of Lethbridge (Canada), California State University (USA), IUCAA (India).

Research Programs

The scientific staff of RCAAM participated during 2015 in the following programs:

1. "Non-linear phenomena in galactic discs". Program of the Research Committee of Academy of Athens (200/815). (G. Contopoulos, P.A. Patsis, C. Efthymiopoulos, M. Harsoula, M. Katsanikas, N. Delis, I. Alikakos).

Publications in journals with referees No: "3", "5", "6". Talks: GC-1, PP-1, PP-2, MH-1. There have been made observations with the telescope "Aristarchos" at Helmos.

2. "Galactic dynamics". Program funded by the G.T. Foteinos bequest of the Academy of Athens (200/823) (G. Contopoulos, P. Patsis, L. Tsigaridi).

Publications in journals with referees No: "4".

3. "Diffusion of research results" Program funded from the general bequests for education of the Academy of Athens (200/822) (G. Contopoulos, N. Delis). Conduct of 39 seminars at the RCAAM (see catalog in the paragraph "Seminars").

4. "Study of the stellar orbits and the gravitational potentials in galaxies with theoretical, numerical and observational methods". Program of Instituto Nacional de Astrofisica Optica y Electronica, Mexico, funded by the National Council for Research and Technology of Mexico (SEP-Conacyt). Coordinator: I. Puerari. Participation (P. Patsis). Duration: 2015-2018. The program includes the supervision of a PhD thesis. One research paper under preparation.

5. "The role of magnetic fields in the heating of solar action centers and flares". Program of the Research Committee of the Academy of Athens (200/790). (G. Contopoulos, C. Gontikakis, P. Syntelis). Publication in journal with referees No "25".

6. "N-body simulations of galactic disks – The relation between observed spiral disk morphologies and the dynamical properties of DM halos" (P. Patsis, A. Burkert. University of Munich, T. Naab, Max Planck Institute für Astronomie, P. Grosbol, European Southern Observatory, Munich). Program funded by the interdisciplinary program of excellence "Excellence Cluster " involving the Polytechnical School (TU) and the University (LMU) of Munich, the institutes Max-Planck for Astrophysics and extrasolar Physics in Munich and the European Southern Observatory (ESO). Computational time is provided in the Computational Center RZG, Garching, Germany, where numerical simulations with N-body models are conducted.

7. "Feeding supermassive Black Holes". (K. Fathi, University of Stockholm, P. Patsis, S. Kitsionas). Program funded by the Swedish Royal Academy of Sciences (KVA). One publication under print.

8. Marie Curie innovative Training Network "Stardusta" (2015-2016). Program of the European Committee. RCAAM participates as an Associate Partner represented by C. Efthymiopoulos. Missions-visits in the University of Rome Tor Vergata. Participation in the supervision of Fabien Gachet's PhD on the dynamics at the geostationary ring. One publication submitted for review in an international journal with referees.

9. "COST Action MP1006: Fundamental Problems in Quantum Physics" (C. Efthymiopoulos as national representative in management committee). Funded by from the European Science Council.

10. "Resonant co-orbital dynamics, with applications to extrasolar planetary systems" (C. Efthymiopoulos, R. Paez) (not funded). One publication submitted for publication.

11. "Analytic Computation of Invariant Manifolds and the structure of Chaos" (G. Contopoulos, C. Efthymiopoulos, M. Harsoula, M. Katsanikas) (not funded). Publications in journals with referees No: "1", "2".

12. "Study of the dynamical evolution of the entanglement and coherence in quantum systems" (C.

Efthymiopoulos, A. Tzemos) (not funded).

13. "The origin of Astrophysical Magnetic Fields" under "Aristeia" Action of the Ministry of Education, 2012-2015. Principal Investigator: I. Contopoulos. Scientific Collaborators: D. Papadopoulos (senior member), N. Stergioulas, K. Kleidis, D. Kazanas, D. Christodoulou, K. Kalapotharakos, K. Fukumura, D. Gabuzda (collaborators). Total revised budget: 248400 €.

Publications in journals with referees No: "7", "9", "10", "11", "12", "13".

Special Editions: "1".

Talks: "IC-3", "IC-4", "IC-5", "IC-6", "IC-7".

14. "MPNS COST Action MP1304, Exploring fundamental physics with compact stars" (directed by Pr. Luciano Rezzola). Participation: I. Contopoulos. Funded by the European Science Council. (Program that can be used for the funding of participation and organization of conferences).

15. "Using starburst galaxies to trace the cosmic acceleration" (S. Basilakos, M. Plionis, AUT, R. Terlevich, Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE), Mexico and University of Cambridge. It is about a collaboration of RCAAM with the National Observatory of Athens, Institute INAOE of Mexico and the University of Cambridge. It is financially supported by INAOE (duration 2011-2018).

Publication in journal with referees No: "21"

16. " XMM-Newton Very Large Programme". Program of European Space Agency (ESA) with collaboration between many Universities and Institutes. Dr. Basilakos is the scientific director of the section named "AGN Cosmology" (not funded). (Duration 2010-2020).

Publication in journal with referees No: "22"

17. "The nature of dark energy". Research Program for the study of the nature of dark energy. It is a collaboration between several Universities (S. Basilakos, M. Plionis, AUT, J. Sola (Un. of Barcelona), S. Capozziello (Un. Of Naples), A. Lima (Un. of Sao Paulo) and N. Mavromatos (King College, Un. of London). It is financially supported by the Universities of Barcelona, Naples and Sao Paulo (Duration 2011-2018).

Publications in referees with reviewers No: "14", "15", "16", "17", "18", "19", "20", "23", "24".

18. "Greek National Network of Research of Space Weather". Thalys Program of the General Secretariat for Research and Technology (10/2012-9/2015), - Principal Investigator: Prof. Loukas Vlahos, AUT. (Participators from RCAAM: C. Efthymiopoulos (collaborating member), C. Gontikakis, M. Georgoulis, members of the senior research group).

Publication in journals with referees No: "28".

Talks: "MG-4", "MG-7", "MG-9", "MG-10".

19. "Solar small scale events and their role in the heating of the solar atmosphere" (Aristeia II in Solar Physics). Program of the General Secretariat for Research and Technology (GSRT) funded by GSRT. Principal Investigator: G. Tsiropoula (1/2014 – 10/2015), Institute of Astronomy, Astrophysics, Space Applications and Remote Sensing of National Observatory of Athens. Participators fro RCAAM: C. Gontikakis, M. Georgoulis.

20. "Athens Effective Solar Flare Forecasting (A-EFFort)". Sponsor: European Space Agency (ESA), 10/2014-12/2015. Total budget: 100.000 €. Scientific Director: M. Georgoulis.

Talks: "MG-5", "MG-15", "MG-17", "MG-18".

21. "Magnetic Helicity Estimations in Models and Observations of the Solar Magnetic Field". Program of the International Space Sciences Institute (ISSI), Bern, Switzerland. Principal Investigators: G. Valori, Mullard Space Science Laboratory (MSSL), Great Britain and E. Pariat, Observatoire de Paris-Meudon, LESIA, France. Participator from RCAAM: M. Georgoulis. Program funded by ISSI. Duration: 12/2014-9/2016.

22. "Improving the Reliability of Solar Eruption Predictions to Facilitate the Determination of Targets-of-Opportunity for Instruments with a Limited Field of View". Program of the International Space Science Institute (ISSI), Bern, Switzerland. Principal Investigators: P. Higgins, Trinity College, Dublin, Ireland and M. Georgoulis, RCAAM of the Academy of Athens. Duration 12/2014-12/2016.

23. "Forecasting Solar Energetic Particles and Flares (FORSPEF)". Program of the European Space Agency (ESA), funded by ESA. Coordinator: A. Anastasiadis (National Observatory of Athens). Participant from RCAAM: M. Georgoulis.

Publication in conference proceedings No: "4".

24. "Flare Likelihood and Region Eruption Forecasting (FLARECAST)". Program Horizon 2020 of the European Committee (1/2015-12/2017). Scientific Coordinator: M. Georgoulis. Participant: C. Gontikakis. Total budget: 2.415.000 € (Budget of RCAAM of the Academy of Athens: 375.000 €).

25. "Development of the ASPIICS Coronagraph for the PROBA-3 Mission" Program of the European Space Agency (ESA). Principal Investigator from Greece: K. Tsiganos, (UOA). Participants from RCAAM: C. Gontikakis, M. Georgoulis. The program is financially supported by ESA through the University of Athens and is underway since 2009.

26. "VarSITI/ISEST/MiniMax24": Program of the Scientific Committee for Solar Terrestrial Physics (SCOSTEP). Principal Investigators: J. Zhang, G. Mason University, USA, M. Temmer, University of Graz, Austria and N. Gopalswamy, NASA Goddard Space Flight Center. Duration 1/2014-12/2018. Participant from RCAAM: M. Georgoulis (not funded).

27. "Construction of experimental station for the measurement of Schumann waves and preliminary measurements. Scientific Director of research program, V. Tritakis. Program funded by Mariolopoulou Foundations and the University of Ioannina. Experimental measurements also work for the construction of a permanent station are underway.

Talks: "VT-1"

Publications in 2015

During 2015 there were published or accepted for publication 41 papers, of which 32 were in journals with referees.

Specifically the publications are:

Special Editions

1. The volume with title "The Formation and Destruction of Black Hole Jets" is published, eds. I. Contopoulos, D. Gabuzda and N. Kylafis (Springer Verlag-Berlin), with Dr. I. Contopoulos as main editor.
2. The special edition of the journal *Int. J. of Mod. Phys. D.* was published with subject "Testing inflationary scenarios with the Planck and BICEP2 data", Volume: 24, Number: 04 (April 2015), eds. S. Basilakos, M. Plionis, with S. Basilakos as main editor.
3. Dr. Georgoulis was the editor of the special volume of the journal *Advances in Space Research*, "ESPM-14 Topical Issue entitled *Advances in Solar Physics*" (eds. M. K. Georgoulis & V. M. Nakariakov), *Adv. Space Res.*, 56(12), 2015. The volume was published for the conference named "14th European Solar Physics Meeting".
4. Dr. Georgoulis was the editor for the 12th issue of the journal of Hellenic Astronomical Society "Hipparchos".

Publications in International Journals with Referees

1. Contopoulos, G. and Harsoula, M., 2015, "Convergence regions of the Moser normal forms and the structure of chaos", *J. Phys. A. Math. Theor.* 48, 335101.
2. Harsoula, M., Contopoulos, G., Efthymiopoulos, C., 2015, "Analytic description of the structure of chaos". *J. Phys. A. Math. Theor.* 48, 135102.
3. Efthymiopoulos, C., Harsoula, M., and Contopoulos, G., 2015, "Resonant normal form and asymptotic normal form behavior in magnetic bottle Hamiltonians", *Nonlinearity*, 28, 851.
4. Tsigaridi, L. and Patsis, P. A., 2015, Morphologies introduced by bistability in barred-spiral galactic potentials, *Month. Not. R. Ast. Soc.* 448, 3081.
5. Paez, R., Efthymiopoulos, C., 2015. "Trojan resonant dynamics, stability, and chaotic diffusion, for parameters relevant to exoplanetary systems". *Cel. Mech. Dyn. Astron.*, 121, 139.
6. Delis, N., Efthymiopoulos, C., Kalapotharakos, C.: 2015. "Effective power-law dependence of Lyapunov exponents on the central mass in galaxies", *Mon. Not. R. Astr. Soc.*, 448, 2448.
7. Contopoulos, I., Nathanail, A., Katsanikas, M., 2015, "The Cosmic Battery in Astrophysical Disks", *Astrophys. J.*, 805, 105.
8. Fukumura, K., Tombesi, F., Kazanas, D., Shrader, C., Behar, E., Contopoulos, I., 2015, "Magnetically Driven Accretion Disk Winds and Ultra-fast Outflows in PG 1211+143", *Astrophys. J.*, 805, 17.
9. Papadopoulos, D. B., Contopoulos, I., Kokkotas, K. D., Stergioulas, N., 2015, "Radiation from charged particles on eccentric orbits in a dipolar magnetic field around a Schwarzschild black hole", *Gen. Rel. Grav.*, 47, 49.
10. Nathanail, A., Contopoulos, I., 2015, "Are Ultra Long Gamma Ray Bursts powered by black holes spinning down?", *Mon. Not. R. Astr. Soc.* 453, L1.
11. Contopoulos, I., Esposito, F. P., Kleidis, K., Papadopoulos, D. B., Witten, L., 2015, "Generating Solutions to the Einstein-Maxwell Equations", *Int. J. Math. Phys. D*, in press.

12. Contopoulos, I., Esposito, F. P., Kleidis, K., Papadopoulos, D. B., Witten, L., 2015, "Generating Solutions to the Einstein Field Equations", *Gen. Rel. Quant. Cosm.*, in press.
13. Nathanail, A., Strantzas, A., Contopoulos, I., 2015, "The rapid decay phase of the afterglow as the signature of the Blandford-Znajek mechanism", *Mon. Not. R. Astr. Soc.*, in press.
14. Paliathanasis A., Tsamparlis M., Basilakos S, Barrow J., 2015, "Dynamical analysis in scalar field cosmology", *Phys. Rev. D.* 91, 123535.
15. Gomez-Valent Andria, Sola J., Basilakos S., 2015, "Dynamical vacuum energy in the expanding Universe confronted with observations: a dedicated study", *J. Cosm. Astropart. Phys.*, 01, 004
16. Basilakos S., Sola J., 2014, "Growth index of matter perturbations in running vacuum models", 2015, *Phys. Rev. D.* 92, 123501.
17. Lima J. A.S., Basilakos S., Sola J., 2015, "Nonsingular decaying vacuum cosmology and entropy production", *Gen. Rel. Grav. Cosm.* 47, 4.
18. Basilakos S., 2015, "The growth index of matter perturbations using the clustering of dark energy", *Mon. Not. R. Ast. Soc.* 449, 2151.
19. Basilakos S., 2015, "Cosmic expansion and structure formation in running vacuum cosmologies", *Mod. Phys. Lett. A.* 30, 1540031.
20. Basilakos S., Barrow J., 2015, "Hyperbolic inflation in the light of Planck 2015 data", *Phys. Rev. D.*, 91, 103517.
21. Terlevich R., Terlevich E., Melnick J, Chavez R., Plionis M., Bresolin, F., Basilakos S., "On the road to precision cosmology with high-redshift H II galaxies", 2015, *Mon. Not. R. Ast. Soc.* 451, 3001.
22. Mehrabi A., Basilakos S., Pace F., 2015, "How clustering dark energy affects matter perturbations," *Mon. Not. R. Ast. Soc.* 452, 2930.
23. Mehrabi A., Basilakos S., Malekjani M., Davari Z., 2015, "Growth of matter perturbations in clustered holographic dark energy cosmologies", *Phys. Rev. D.* 92 123513.
24. Basilakos S., Plionis M., 2015, "Special Issue: Testing Inflationary Scenarios with the Planck and BICEP2 Results", *Int. J. Mod. Phys. D.* 24, 1502001.
25. Syntelis, P., Archontis, V., Gontikakis, C., Tsinganos, K., 2015, "Emergence of non-twisted magnetic fields in the Sun: Jets and atmospheric response", *Astron. Astrophys.* 584, 10.
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28. Patsourakos, S., Georgoulis, M. K., Vourlidas, A., et al. 2015, "The Major Geoeffective Solar Eruptions of 7 March 2012: Comprehensive Sun-to-Earth Analysis", *Astrophys. J.* in press.
29. Bisbas, Th. G.; Papadopoulos, P. P.; Viti, S., 2015, "Effective Destruction of CO by Cosmic Rays: Implications for Tracing H2 Gas in the Universe", *Astrophys. J.* 803, 37.
30. Carvalho C.S., 2015, "Integrated probability of coronary heart disease subject to the -308 tumor necrosis factor-alpha SNP: a Bayesian meta-analysis, *PeerJ* 3, 31236.
31. Carvalho C.S., Marques K., 2015, "Angular distribution of cosmological parameters: measurement of inhomogeneities from type Ia supernovae", *Mon. Not. R. Ast. Soc.* In press, arXiv:1512.07869.
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Publications in Conference Proceedings with Referees

1. Fukumura, K., Tombesi, F., Kazanas, D., Shrader, C., Behar, E., Contopoulos, I. 2015, "Fast Ionized X-ray Absorbers in AGNs", The Extremes of Black Hole Accretion, Proceedings of the conference held 8-10 June, 2015 in Madrid, Spain.
2. Contopoulos, G., Delis, N., Efthymiopoulos, C.: 2015, "Bohmian Trajectories in the Scattering Problem", in *Chaos, Information Processing and Paradoxical Games: the legacy of John S Nicolis*, World Scientific, pp.3 – 25.
3. Efthymiopoulos, C.: 2015, "Perturbative methods in Celestial Mechanics and the roots of Quantum Mechanics: A historical perspective", in *Rivista dell'Unione Matematica Italiana*, Ser. I, 8, pp.1 – 35.
4. Pouri A., Basilakos S., 2015, "Testing General Relativity on cosmological scales", in *Journal of Physics: Conference Series*, Volume 633, 012035.
5. Papaioannou, A., Anastasiadis, A., Sandberg, I., Georgoulis, M. K., Tsiropoula, G., Tziotziou, K., Jiggins, P., & Hilgers, A., 2015, "A Novel Forecasting System for Solar Particle Events and Flares (FORSPEF)", in *J. Phys.: Conf. Series*, 632(1), article id. 012075.

Other Works

1. Georgoulis, M. K.: Greece and ESA: *A Membership and Relation that is Imperative to Maintain, in Spite of Problems*, Hipparchos, 2(12), pp. 4 – 5, June 2015.
2. Georgoulis, M. K. & Zoulias, M.: *Cosmic Light: Primordial and Eternal*, e-EPS Newsletter, 23 November 2015.

Publications in Greek

1. G. Contopoulos, 2015, "Chaos and Randomness", Physics News, Hellenic Physical Society, March 2015.
2. L. Vlahos and M. Georgoulis: Black lenses for an Eclipse, article from the President and the Vice-President of Hellenic Astronomical Society. Newspaper "TA NEA", 28 April 2015.

Participation in Conferences and Talks¹

G. Contopoulos

- GC-1. "Analytic Study of Chaos", invited talk in the conference "PhD School on Complexity Science", Patras, 24-7-2015.
- GC-2. "100 since the birth of General Theory of Relativity", Invited introductory talk in the Academy of Athens for the celebration of 100 years from the foundation of the General Theory of Relativity, organized by the Hellenic Society on Relativity, Gravitation and Cosmology, 24-11-2015.

P. Patsis

- PP-1. "Dynamical Mechanisms Supporting Boxy Structures in Galactic Bars", invited talk in the University of Oulu, Finland, 11-2-2015.
- PP-2. "The importance of inner boxiness for understanding barred galaxies dynamics", talk in the 12th international conference of the Hellenic Astronomical Society, Thessaloniki, 29-6-2015.
- PP-3. Coordination of the meeting about "Extragalactic Astronomy and Astrophysics", 1-7-2015, in the 12th international conference of the Hellenic Astronomical Society.

C. Efthymiopoulos

- CE-1. "Analytical study of chaos with convergent series for the invariant manifolds". Internal seminar of the Applied Analysis Division of the Department of Mathematics, University of Patras 14-5-2015.
- CE-2. "Arnold diffusion estimates through optimal normal form computations in Hamiltonian systems" Floris Takens Seminar, Johann Bernoulli Institute for Mathematics and Computer Science, University of Groningen, Netherlands, June 2015.
- CE-3. "Theory and applications of hyperbolic invariant manifolds", invited talk in the 12th international conference of the Hellenic Astronomical Society, Salonica, 1-7-2015.
- CE-4. "Analytical study of classical and quantum complexity" in 5th PhD School - Conference on "Mathematical Modelling of Complex Systems", Patras, July 2015.
- CE-5. "Estimation of the speed of Arnold diffusion via the calculation of the canonical forms at the optimized order in Hamiltonian Systems" COSA Seminar, NCSR Demokritos, 24-6-2015.

I. Contopoulos

- IC-1. "Magnetohydrodynamic simulations in Astrophysics: Extreme flows in neutron star and black hole magnetospheres", MEPhI, Moscow, 3-11-2015.
- IC-2. "Magnetohydrodynamic simulations in Astrophysics: Magnetic models of the solar corona", MEPhI, Moscow, 5-11-2015.
- IC-3. "Where does the magnetic field come from?" invited talk in the international conference "Relativistic Jets: Creation, Dynamics, and Internal Physics", Krakow, Poland, 21-4-2015
- IC-4. "The Force-Free Electrodynamics Method" invited talk in the framework of the international working team with subject "Global Non-Potential Magnetic Models of the Solar Corona", International Space Science Institute (ISSI), Bern, Switzerland, 24-8-2015.
- IC-5. "Magnetism and Spin", talk in the 12th international conference of the Hellenic Astronomical

¹The talks of RCAAM members in the RCAAM seminars and in the events for the celebration of the International Year of Light, are presented in the table of seminars and public outreach section correspondingly.

Society, Thessaloniki, 28-6-2015.

- IC-6. "What about black hole spin down in GRB observations" poster in the international conference "Relativistic Jets: Creation, Dynamics, and Internal Physics", Krakow, Poland, 20-24/4-2015.
- IC-7. Participation with teleconference in the Mini Workshop with title "Kinetic Processes in Pulsar Magnetospheres", Princeton University, 9 February 2015.

S. Basilakos

- SB-1. "Geometrodynamics in Cosmology: from Planck to modified gravity", invited talk in the 12th conference of the Hellenic Astronomical Society, Thessaloniki, 2-7-2015.
- SB-2. "Recent developments in Cosmology", invited talk in the international conferences of Applied Physics, Mykonos, June 2015.
- SB-3. "Cosmology after 100 years from the General Theory of Relativity", invited talk in the Academy of Athens on the occasion of the celebration of 100 years from the foundation of General Theory of Relativity, organized by the Hellenic Society on Relativity, Gravity and Cosmology, 25-11-2015.

C. Gontikakis

- CG-1. "Study of Plasma Flows along Loops and the Inclination of Coronal Loops Using Data from SOHO/SUMER and Hinode/EIS", talk in the International Conference of Solar Physics "Multi-Wavelength Studies of the Solar Atmosphere" in honor of Prof. Costas Alissandrakis, Ioannina 21-9-2015.
- CG-2. "Memories of working with Costas Alissandrakis", talk in the International Conference of Solar Physics in honor of Prof. Costas Alissandrakis, (as CG-1), Ioannina 24-9-2015.
- CG-3. "Anomalous profiles of the C IV 1548 Å and 1550 Å observed with SOHO/SUMER. A result of resonant scattering?" C. Gontikakis, J.-C. Vial, Poster in the International Conference of Solar Physics in honor of Prof. Costas Alissandrakis, Ioannina 21-9-2015.

M. Georgoulis

- MG-1. Coordination of the meeting: "FLARECAST Kick-Off Meeting". Opening meeting of the European program FLARECAST, Brussels, Belgium, 14 – 15 January 2015.
- MG-2. Invited talk: "*Solar Flare Prediction: Problems, Methods, Open Questions*" in the project meeting "Improving the Reliability of Solar Eruption Predictions to Facilitate the Determination of Targets-of-Opportunity for Instruments with a Limited Field of View" της International Space Science Institute (ISSI), Bern, Switzerland, 26 – 30 January 2015.
- MG-3. Talk: "*Flare Likelihood and Region Eruption Forecasting*". In the same workshop as MG-1.
- MG-4. Invited talk: "Structure and Dynamics in the Solar Magnetic Atmosphere: Key Parameters and Properties." in the "2nd SOLARNET Meeting: Solar and Stellar Magnetic Activity". Project meeting of the European network SOLARNET, Palermo, Italy, 2 – 5 February 2015.
- MG-5. "Project Meeting 2 of the A-EFFort Project". Project meeting for the progress of the A-EFFort program of ESA, Athens, 4 May 2015. Coordination of the meeting and a presentation.
- MG-6. Participation in the "First FLARECAST Project Management Board Meeting". Project meeting for the progress of the European program FLARECAST, Athens, 9 – 10 June 2015.
- MG-7. Invited talk: "*Tracing the Origins of Solar Magnetic Eruptions*. 26th International Union of Geodesy and Geophysics (IUGG) General Assembly", Prague, Czech Republic, 22 June – 2 July 2015.
- MG-8. Invited talk "*Greece and ESA's Science Programme Committee: National Involvement*" in the

12th international conference of the Hellenic Astronomical Society. Thessaloniki, 28 June – 2 July 2015.

- MG-9. Poster: *“Physics of a Critical Scaling in Solar Magnetism”* in the same conference as talk MG-8.
- MG-10. Invited talk: *“Inferring the Nature and Properties of the Unknown 3D Magnetic Field above the Solar Photosphere”* in the international conference for Solar Physics *“Multi-Wavelength Studies of the Solar Atmosphere”* in honour of Prof. Kostas Allisandrakis, 21-9-2015.
- MG-11. Coordination of the meeting of 24-9-2015 in the same conference as MG-10.
- MG-12. Invited talk: *“Physics with Magnetic Helicity: Active Regions, Quiet Sun, and the CME (Axial) Magnetic Field”* in the project meeting of the *International Space Science Institute (ISSI)*, *“Magnetic Helicity Estimations in Models and Observations of the Solar Magnetic Field”*, Bern, Switzerland, 12-16 October.
- MG-13. Talk: *“Connectivity Method Applied to Feng Chen’s Simulation”* in the same conference as MG-12.
- MG-14. Coordination of the project meeting for the European program FLARECAST, Windisch, Fachhochschule Nordwestschweiz, Windisch, Switzerland, 15-10-2015.
- MG-15. Invited talk *“Solar Eruption Prediction: Status, Science, Open Questions”* in the international conference *“Solar Variability and Its Heliospheric Effects”*, Athens, 2 – 6/11-2015.
- MG-16. *“Enhanced Observational Data Cadence and Advances in Discriminant Analysis for Solar Flare Prediction”*. Talk in the conference *“12th European Space Weather Week (ESWW12)*, Ostend, Belgium, 23 – 27 November 2015.
- MG-17. *“A Possible Osmosis between Existing and Future Products within the SSA/SWE Service Network”*. Talk in the same conference as MG-16.
- MG-18. *“Performance Verification of ESA’s SSA/SWE A-EFFort Service”* Talk in the same conference as MG-16.
- MG-19. *“FLARECAST: An Overview”* Poster in the same conference as the talk MG-16.
- MG-20. Coordination of project team and videoconference of the European program FLARECAST as well as of the participation of the program in a special exposition during the same conference as MG-16.
- MG-21. Overall presentation of the A-EFFort project in the project meeting for the end of the implementation period of the A-EFFort project of ESA, Darmstadt, Germany, 8-12-2015. Furthermore, Dr. Georgoulis had two participations as the National Representative of the Scientific Program Committee of the European Space Agency (ESA), and one as the President of the Solar Physics Division of the European Physics Society in the project meeting of its Council.
- MG-22. ESA Science Program Committee Meeting 146, Paris, France, 10 – 11 February 2015.
- MG-23. European Physical Society Council Meeting, Bad Honnef, Germany, 27 – 28 March 2015.
- MG-24. ESA Science Program Committee Meeting 148, Paris, France, 4 – 5 November 2015.

M. Harsoula

- MH-1. *“Convergence regions of the Moser normal forms and the structure of chaos”*, talk in the 12th international conference of the Hellenic Astronomical Society, Thessaloniki, 29-6-2015.

V. Tritakis

- VT-1. *“Preliminary Measurements of Schumann's Resonances (SR) in the Greek Area - Part B.”*, talk in the 12th international conference of the Hellenic Astronomical Society, Thessaloniki, 29-6-2015 (work with: Repapis, C., Tatsis, G., Votis, K., Christofilakis, V., Kostarakis, P.).

Organization of Conferences and Meetings

Dr. Georgoulis organized:

1. The conference “Heliophysics and the Solar System”, in the 12th international conference of the Hellenic Astronomical Society, Thessaloniki, 28 June – 2 July 2015.
2. The conference “Solar Storms: Flares, CMEs, and Solar Energetic Particle (SEP) Events, 12th European Space Weather Week (ESWW12)”, 23 – 27 November 2015 (with Dr. Nicole Vilmer, Observatoire de Paris – Meudon, France and Olga Malandraki, National Observatory of Athens).
3. The project meeting: FLARECAST Kick-Off Meeting, Brussels, Belgium, 14 – 15 January 2015.
4. The project meeting: Improving the Reliability of Solar Eruption Predictions to Facilitate the Determination of Targets-of-Opportunity for Instruments with a Limited Field of View, ISSI, Bern, Switzerland, 26 – 30 January 2015 (with Dr. Paul Higgins, Lockheed Martin, Palo Alto, California, USA).
5. Project meeting: Project Meeting 2 of the A-EFFort Project, Athens, 4 May 2015.
6. Project meeting: First FLARECAST Project Management Board Meeting, Athens, 9 – 10 June 2015.

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 2015 39 seminars took place at RCAAM, most of them about Astronomy, Astrophysics and Mechanics.

The invited speakers were, beside 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.

Date	Speaker	Title
22 Dec	Georgios Loukes-Gerakopoulos ITP, Charles University in Prague, Czech Republic	The motion of a spinning particle in a curved spacetime
15 Dec	Panos Patsis Research Center for Astronomy, Academy of Athens	Lens features in galactic models
15 Dec	Heikki Salo & Eija Laurikainen , Astronomy and Space Physics Department, University of Oulu, Finland	Barlenses and their connection to boxy/peanut/X-shape bulges
8 Dec	Athina Pouri Research Center for Astronomy and Applied Mathematics of the Academy of Athens	Testing General Relativity on cosmological scales using Large Scale Structure and High Energy Extragalactic Sources
1 Dec	Athanasios C. Tzemos Research Center for Astronomy and Applied Mathematics of the Academy of Athens	Quantum Paradoxes
24 Nov	Kalliopi Dasyra University of Athens	Molecular gas outflows driven by the jets of AGN
10 Nov	Charalampos Markakis University of Southampton	Hamiltonian Hydrodynamics & Binary Neutron Stars
3 Nov	Sotiris Chatzopoulos Institute for Theoretical Physics (ITP), Goethe University, Frankfurt, Germany	The old nuclear star cluster in the Milky Way: dynamics, mass, statistical parallax, black hole mass and dust extinction
27 Oct	Antonio Nathanail Institute for Theoretical Physics (ITP), Goethe University, Frankfurt, Germany	Looking at the black hole that powers Long Gamma Ray Bursts
20 Oct	Konstantinos Karamanos TEI of Athens	Distributional Questions in Non-Linear Science: A computational and explanatory perspective
14 Oct	Demosthenes Kazanas NASA/GSFC, Univ. of Maryland, Corresponding Member of the Academy of Athens	X-ray Absorbers in Active Galactic Nuclei (AGN) and Galactic Binary Sources
6 Oct	Panagiotis Kyziropoulos	A new Particle Mesh N-body code based

	Democritus University of Thrace	on Approximate Inverse Matrix Techniques
29 Sep	Constantinos Skordis University of Cyprus	Linking tests of gravity from cosmology to the Earth and beyond
22 Sep	Christos Efthymiopoulos Research Center for Astronomy and Applied Mathematics of the Academy of Athens	The concept of Laplace plane and the 3D dynamics in the geostationary ring
15 Sep	Ioannis Contopoulos Research Center for Astronomy and Applied Mathematics of the Academy of Athens	Review of Magnetic Models of the Solar Corona
1 Sep	Aleksander Sadowski Massachusetts Institute of Technology	Simulations of Radiative Black Hole Accretion in General Relativity
23 Jun	Amalia Gkana and Loukas Zachilas Department of Economics, University of Thessaly	Chaotic dynamics and population outbreaks in ICD-10-A54 transmission and prey-predator interactions
16 Jun	Haris Skokos Department of Mathematics and Applied Mathematics, University of Cape Town	Chaotic behavior of disordered nonlinear lattices
9 Jun	Georgios Loukes-Gerakopoulos ITP, Charles University, Prague	Motion of spinning particles around black holes
4 Jun	Roger Blandford Stanford University / KIPAC	The Music of the Sphere: overview of cosmology plus new approach to mapping the observable universe
2 Jun	Denize Gabuzda Cork University, Ireland	The Tenacious Helical Magnetic Fields of AGN Jets
26 May	Vasileios Paschalidis Princeton University	Black hole collisions as sources of gravitational and electromagnetic waves
19 May	C. Tsironis National Observatory of Athens	Analysis of charged particle dynamics in the inner magnetosphere during the occurrence of geomagnetic disturbances
12 May	Manolis K. Georgoulis Research Center for Astronomy and Applied Mathematics of the Academy of Athens	The Athens Effective Solar Flare Forecasting (A-EFFort) Project: RCAAM's Contribution to ESA's Space Situational Awareness (SSA) Programme
5 May	Martin Mestre Instituto de Astrofisica La Plata (CONICET-UNLP), Argentina	The effects of the triaxiality of dark matter halos on stellar streams
28 Apr	Costis Gontikakis Research Center for Astronomy and Applied Mathematics of the Academy of Athens	Spectroscopic study of active region NOAA 11429 before two major Coronal Mass ejections
20 Apr	Padelis Papadopoulos ESO visitor scientist, Ernest Rutherford Fellow (University of Cardiff), Assistant Professor, University of Thessaloniki	A major effect of Cosmic Rays on the ISM discovered: implications for tracing H ₂ gas in the Universe
1 Apr	Serguei Komissarov Leeds University	The Physics of the Crab Nebula

24 Mar	Athanasios C. Tzemos Research Center for Astronomy and Applied Mathematics of the Academy of Athens	Entropy In Quantum Mechanics
17 Mar	Christos Efthymiopoulos Research Center for Astronomy and Applied Mathematics of the Academy of Athens	Space Debris and resonant dynamics in the geostationary ring
10 Mar	Demetrios Papadopoulos Aristotle University of Thessaloniki	Frequency Spectrum of Radiation from Accelerated Charged Particles in a Magnetized Curved Space Time
3 Mar	Ioanna Leonidaki National Observatory of Athens / IAASARS	Detection and Study of Extragalactic multi- wavelength Supernova Remnants
25 Feb	Elias Koulouridis National Observatory of Athens / IAASARS	The environment of AGN - Exotic AGN
17 Feb	Maria Petropoulou(1) & Stavros Dimitrakoudis(2) (1) Dept. of Physics & Astronomy, Purdue University, (2) National Observatory of Athens / IAASARS	Investigating the origin of high energy astrophysical neutrinos
10 Feb	Costis Gontikakis Research Center for Astronomy and Applied Mathematics of the Academy of Athens	Particle acceleration in nanoflares and the heating of the solar corona
3 Feb	Kalliopi Dasyra University of Athens, Physics Department, Section of Astronomy, Astrophysics and Mechanics	AGN jets affecting galaxy evolution: evidence from observations
27 Jan	Marina Vika National Observatory of Athens / IAASARS	MegaMorph: developing advanced galaxy decomposition software for multi- wavelength surveys
20 Jan	Kosmas Gazeas Dept. of Physics, University of Athens	Contact Binaries and Stellar Mergers
13 Jan	Academician George Contopoulos Research Center for Astronomy and Applied Mathematics of the Academy of Athens	Chaos and Chance

Teaching

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

- Dr. **Patsis** taught, under assignment, the postgraduate lesson “Galactic and Extragalactic Astronomy” of the Astronomy, Astrophysics and Mechanics Division of UOA, during 2014-2015 and 2015-2016 (in collaboration with assistant professor Dr. S. Kazantzidis).
- Dr. **Efthymiopoulos** taught, under assignment, the postgraduate lesson “Dynamical Astronomy” in the postgraduate program Astronomy-Astrophysics of the Physics Department of UOA. He also taught, after invitation, the lesson “Applications of Canonical Perturbation Theory in Dynamical Astronomy” in doctoral program of the Mathematics Department of the University of Padova.
- Dr. **Basilakos** taught the lesson of Cosmology (winter and spring semester of 2015) in the Mathematics and Physics Departments of UOA. During the winter semester of 2015 he taught Cosmology to postgraduate students of the Physics Department of UOA.

PhDs and Masters

In RCAAM there are 6 doctoral and postgraduate students working on their PhD's and Masters correspondingly. Moreover RCAAM researchers participate in other PhD supervision committees outside of RCAAM. Specifically, during 2015 RCAAM members supervised the PhDs of:

E. Tsigaridi, “Nonlinear phenomena in response models of disc galaxies” (Supervisor P. Patsis)

A. Nathanail “The origin of the magnetic fields in Astrophysics” (Supervisor I. Contopoulos)

A. Pouri, (scholar of the Academy of Athens), “The study of the nature of dark energy using extragalactic high energy sources” (Supervisor S. Basilakos)

P. Syntelis, “The emergence of magnetic flow from the Sun, solar jets and stemmatic ejections of mass” (Supervisor C. Gontikakis)

E. Koutsantoniou, “Cosmic battery in accretion discs around astrophysical black holes” (Supervisor I. Contopoulos)

and the Masters of:

K. Dima, “The spiral structure of galactic discs and the determination of corotation with kinematic methods” (Supervisor P. Patsis)

E.M Chrisafeli, “Fourier analysis of spiral galaxy models” (supervisor P. Patsis)

All of the aforementioned person are postgraduate students of Physics Department of the UOA.

Furthermore: Dr. Patsis is the co-supervisor of **Leonardo Chavez Velasquez's** PhD in the Instituto Nacional de Astrofisica, Optica y Electronica (INAOE), Puebla, Mexico, with title “Numerical and Analytical Studies of Orbits in Models of Spiral Galaxies” in the framework of the program No "4".

Dr. Efthymiopoulos is one of the three members of **Mr. P. Kyziropoulos's** PhD supervision board with subject “Simulations of N-body systems with pre-resonance techniques”(Department Of Electrical Engineering, University of Thrace)

Dr. I. Contopoulos is one of the three members of **Mr. N. Trifonidis's** PhD supervision board, Department of Physics, University of Thessaloniki. Subject: Computational study of nonlinear phenomena of Magnetohydrodynamic with applications in Astrophysics”.

Dr. Basilakos is one of the three members of **Mr. A. Papageorgiou's** PhD supervision board in the University of Thessaloniki with subject “Cosmological parameters and dark energy”.

Dr. Georgoulis was invited as an external examiner of **Mr. Christopher Nelson's** PhD with title “Properties of Ellerman Bombs with Implications to Formation Mechanisms” (Supervisor: Prof. Robertus von Fay-Siebenburgen, University of Sheffield, Great Britain). PhD was successfully presented in 25 August 2015.

Missions – Visits to other Research Institutions

1. Panos Patsis

Dr. Patsis was invited visitor the University of Oulu in Finland (Institute of Astronomy and Space Physics). During his visit, he gave an invited talk.

2. Christos Efthymiopoulos

He was invited visitor in the Department of Mathematics of University of Rome Tor Vergata during the periods 14/2-28/2 and 15/7-22/7, in the Johann Bernoulli Institute of the Department of Mathematics of the University of Groningen during 8/6-13/6, where he made an invited seminar, and in the Department of Mathematics of the University of Padova during 1/11-30/11, where he made a series of 7 talks in the framework of an invited postgraduate class.

3. Ioannis Contopoulos

Dr. I. Contopoulos visited the National Research Nuclear University (MEPhI) in Moscow, Russia, where he gave two invited talks.

Incoming Visitors

Prof. D. Papadopoulos (AUT) visited RCAAM in order to collaborate with I. Contopoulos in the framework of “ARISTEIA” program. (2 visits in March and June. Total duration one month)

RCAAM hosts for the academic year 2014 – 2015 **Dr. P. Papadopoulos** (School of Physics and Astronomy, University of Cardiff, UK), who is elected as Associate Professor in the University of Thessaloniki. Dr. Papadopoulos is collaborating with Dr. Patsis and Dr. Basilakos.

Dr. **S.C. Carvalho**, postdoctoral researcher of the University of Lisbon, Portugal, visited RCAAM for a month (September 2015) in order to collaborate with Dr. Basilakos.

Participation in European and Greek Committees

The researchers and the scientific collaborators of RCAAM participate in National and European Committees. All of them are members of the Hellenic Astronomical Society (Hel.A.S.) and of the International Astronomical Union (IAU). Furthermore, they participate in the following committees:

- IGBP Committee (International Geosphere - Biosphere Program) of the Academy of Athens (president G. Contopoulos)
- National Committee for the Research of Space of the Academy of Athens (member G. Contopoulos)
- National Mathematical Committee of the Academy of Athens (member G. Contopoulos)

- Committee of Energy of the Academy of Athens (member G. Contopoulos)
- Election Committee of the Center of Theoretical and Applied Mathematics (president G. Contopoulos)
- Election Committee for the Dr. M. Harsoula's accession in the position of Senior Researcher at RCAAM (G. Contopoulos, P. Patsis)
- Election Committee for the promotion into Associate Professor on the subject "Dynamics" in the Department of Physics of the AUT (P. Patsis)
- Election Committee for the promotion into Associate Professor on the subject "Mechanics" in the Department of Physics of UOA (C. Efthymiopoulos)
- Dr. Efthymiopoulos is associate editor of the journal *Celestial Mechanics and Dynamical Astronomy* (Springer), and member of the editorial board of *Serbian Astronomical Journal*.
- Assessor for the promotion into Associate Professor on the subject "Dynamics" in the Department of Physics of AUT (C. Efthymiopoulos)
- Committee "COST Action MP1006" of the European Science Council, C. Efthymiopoulos. National representative in the management Committee)
- I. Contopoulos, panelist of proposals for Universe Sciences for the provision of calculation time in European systems of supercomputers PRACE (Partnership for Advanced Computing in Europe). Brussels, 18-2-2015.
- M. Georgoulis: Assessor for the promotion into Assistant Professor on the subject "Solar Physics" in the University of Ioannina.
- M. Georgoulis. National representative in the Science Programme Committee of the European Space Agency (ESA / Science Program Committee [SPC])
- M. Georgoulis. President in the European Solar Physics Division of the European Physical Society [ESPD/EPS]. Thus invited ex-officio member of board of the Community of European Solar Radioastronomers (CESRA).
- M. Georgoulis. Vice President of the Hellenic Astronomical Society.
- M. Georgoulis. Member of the Scientific Committee of the International Program VarSITI / ISEST/ MiniMax24 whose purpose is the Solar Activity and its effects on Earth.
- M. Georgoulis. Member of the National Committee of the International Committee on Space Research (COSPAR).
- M. Georgoulis. Member of the Organizing Committee of the CE.2 Committee of the International Astronomical Union (IAU) for the Solar Activity.
- M. Georgoulis. Member of the Steering Committee of the space mission JUICE of ESA, due to the Greek participation in the mission.

Finally, all RCAAM researchers are reviewers in prestigious international scientific journals and assess each year tens of papers submitted for publication in these journals. More some of them are evaluators for international scientific proposals and participate in the editorial boards of international journals.

Promotion of Astronomy and Public Outreach

RCAAM, on the occasion of the International Year of Light 2015, organized a series of lectures for the public in the East hall of the main building of the Academy of Athens. The program of the lectures was the following:

Spring Period

6 May 2015

Panos Patsis

The dim light of galaxies

20 May 2015

Manolis Georgoulis

Solar radiation: Light that saves and threatens

3 June 2015

Christos Efthymiopoulos

The discovery of the nature of light

17 June 2015

Spiros Basilakos

Cosmology 100 years after General Theory of Relativity

Autumn Period

2 September 2015

Ioannis Contopoulos

The paths of light

16 September 2015

Constantinos Gontikakis

Solar light: an inexhaustible source of knowledge

30 September 2015

Pantelis Papadopoulos

The Observatory Mauna Kea at Hawaii: On the limit of other worlds

7 October 2015

Mirella Harsoula

Light: The explorer of the Universe

21 October 2015

Vasileios Tritakis

Color in Physics and our lives

The researchers of RCAAM made a lot of invited talks in educational institutions and end events for the public.

P. Patsis (2 talks in the Summer School of the Astronomy and Space Society, Volos, 2 talks in the International Festival of Scientific Movies 2015, Paros (August) and Athens (October) and one in the Christian Scientific Union)

C. Efthymiopoulos (1 talk in an event of the Cultural Center of Avlona and 1 talk in the Christian Scientific Union)

I. Contopoulos (7 talks in educational institutes, 1 in the Christian Scientific Union and 1 in the juvenile detention center of Avlona)

C. Gontikakis (4 talks in educational institutes, 1 in the Christian Scientific Union and 1 in the juvenile detention center of Avlona)

M. Georgoulis (1 talk in the Astronomy and Space Society, Volos, 1 talk in a school, 1 talk in the 3rd Festival of Astronomy in Chios and 1 talk in the juvenile detention center of Avlona)

The supervisor of RCAAM Prof. George Contopoulos gave an interview in the "Astronomy & Astrophysics" journal, as its President during the period 1979-1993.

Dr. Georgoulis gave 3 interviews concerning scientific issues in the newspapers and 3 in TV shows (ALITHIA TV (peripheral channel of North Aegean) Chios, August 2015 and SKAI, September 2015). Moreover there were 3 articles about the research activities of M. Georgoulis, published in the electronic press.