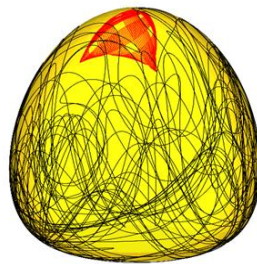




**Research Center for Astronomy
and Applied Mathematics**
of the Academy of Athens

ANNUAL REPORT 2016



$$\begin{aligned} \left(\frac{\dot{R}}{R}\right)^2 + \frac{kc^2}{R^2} &= \frac{8\pi}{3}G\rho + \frac{\Lambda}{3} \\ \frac{\ddot{R}}{R} &= -\frac{4\pi G}{3}\left(\rho + 3\frac{P}{c^2}\right) + \frac{\Lambda}{3} \\ \dot{\rho} &= -3\left(\frac{\dot{R}}{R}\right)\left(\rho + \frac{P}{c^2}\right) \end{aligned}$$



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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 Nbody 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.).

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.

Research Programs

The scientific staff of RCAAM participated during 2016 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: "4", "5". Talks: PP-1, PP-2, PP-4, CE-1, CE-8. One paper submitted in journal with referees. There have been made observations with the telescope "Aristarchos" at Helmos in the optical wavelengths for 3 nights (P. Patsis, M. Ksilouris, I. Alikakos, 29/9-1/10). The analysis of observations and a pertinent paper is in progress
2. **"Galactic dynamics"**. Program funded by the G.T. Foteinos bequest of the Academy of Athens (200/823) (G. Contopoulos, P. Patsis, S. Chatzopoulos). Publications in journals with referees No: "42". A paper in preparation
3. **"Diffusion of research results"** Program funded from the general bequests for education of the Academy of Athens (200/853) (G. Contopoulos, A.C Tzemos). Conduct of 37 seminars at the RCAAM and a special volume of 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 (L.Chavez). 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 "29".
6. **"Analytic Computation of Invariant Manifolds and the structure of Chaos"** (G. Contopoulos, C. Efthymiopoulos, M. Harsoula, N. Delis (not funded).
7. **"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. Grosbøl, 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.

A paper in preparation

Talk: PP-3

8. **"Feeding supermassive Black Holes"**. (K. Fathi, University of Stockholm, P. Patsis, S. Kitsionas). Program funded by the Swedish Royal Academy of Sciences (KVA). One paper in preparation.
9. **'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.
Publications in journals with referees No: "6", "8"
Two more papers submitted for review in journals with referees.
Talks: CE-5, CE-6, CE-7
10. **"Resonant co-orbital dynamics, with applications to extrasolar planetary systems"** (C. Efthymiopoulos, R. Paez) (not funded).
Publications in journals with referees No: "7"
Publications in conference proceedings No: "3"
11. **"Study of the dynamical evolution of the entanglement and coherence in quantum systems"** (C. Efthymiopoulos, A. Tzemos) (not funded).
12. "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).
13. **"Comparison of global non-potential magnetic field models of the solar corona"** international team with subject "Global Non-Potential Magnetic Models of the Solar Corona (coordinator: Pr. Anthony Yeates, Durham University, UK, participation: I. Contopoulos. Funded by the International Space Science Institute (ISSI), Bern, Switzerland. A paper in preparation.
14. **"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).
Publications in journal with referees No: "22", "24"

15. **"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).
Publications in journal with referees No: "19", "21"
16. **"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: "17", "18", "20", "23", "25", "26", "27".
17. **"Flare Likelihood and Region Eruption Forecasting (FLARECAST)"** . Program Horizon 2020 of the European Committee (1/2015-12/2017). Scientific Coordinator: M. Georgoulis. Participator: C. Gontikakis. Total budget: 2.415.000 € (Budget of RCAAM of the Academy of Athens: 375.000 €).
Publication in journal with referees No: "33"
Talks in Conferences CG-1, MG-1, MG-2, MG-9, MG-13
18. **"Athens Effective Solar Flare Forecasting (A-EFFort)"** Sponsor: European Space Agency (ESA), 10/2014-12/2015. Total budget: 100.000 €. Scientific Director: M. Georgoulis. A paper in preparation.
19. **"Dissemination of results A-EFFort"** Program of the Research Committee of the Academy of Athens (200/857) (4400 Euros) (1/2016-12/2017)
Talks in conferences: MG-3, MG-4, MG-5, MG-6 , MG-7, MG-11
20. **"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. 11
Publication No: "36"
Talks in conferences: MG-11
21. **"Improving the Reliability of Solar Eruption Predictions to Facilitate the Determination of Targetsof-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. A paper in preparations
Publications in conferences: MG-12

22. **"Decoding the Pre-Eruptive Magnetic Configurations of Coronal Mass Ejections"**. Program funded by the International Space Science Institute (ISSI), Bern, Switzerland. Main Researchers: Spiros Patsourakos (UOI) and Aggelos Vourlidas (The John Hopkins University Applied Physics Laboratory [JHU/APL], USA. Member of the research team: M Georgoulis. Two papers in preparation. Talks in Conferences: MG-4
23. **"Development of the ASPIICS Coronagraph for the PROBA-3 Mission"** Program of the European Space Agency (ESA). Principal Investigator from Greece: K. Tsiganos, (UOA). Participators from RCAAM: C. Gontikakis, M. Georgoulis. The program is financially supported by ESA through the University of Athens and is underway since 2009.
24. **"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. Participator from RCAAM: M. Georgoulis (not funded). Publication in journal with references No: "34"
25. **"Construction of experimental station for the measurement of Schumann waves and preliminary measurements.** Scientific Director of research program, V. Tritakis. Program funded by Mariolopoulio Foundations and the University of Ioannina. Experimental measurements also work for the construction of a permanent station are underway. Publication in journal with references: "40"

Publications in 2016

Special Editions

During 2016 there were published or accepted for publication 48 papers, of which 43 were in journals with referees. Specifically the publications are:

RCAAM published a special volume (in Greek) with title "Advances in Astronomy" (Eds., G. Contopoulos and P.A. Patsis), which includes a series of papers summarizing the recent research results of RCAAM The contents of the volume are:

- G. Contopoulos: "Analytical study of Order and Chaos"
- P. Patsis: "The structure of galactic bars and the theory of Chaos"
- C. Efthymiopoulos: " The search of Trojan Planets"
- I. Contopoulos: " The origin of magnetic field in the Universe"
- S. Basilakos: " The variable vacuum energy, a key for the understanding of the secrets of the Universe?"

- C. P. Gontikakis: "Solar Physics: Spectroscopy in the UV and study of the particle acceleration in the solar corona"
- M. K. Georgoulis: "Applied Solar Physics: Analysis of the solar magnetic fields and prediction of space weather"
- M. Harsoula: "The road of chaos: analytical description of the chaotic structures in dynamical systems and applications in Dynamical Astronomy"
- V. Tritakis: "Earth environment and near Space"
- G. Contopoulos & M. Harsoula: "Escapes of stars"

Furthermore, Dr. Georgoulis was the editor for the 13th issue of the journal of Hellenic Astronomical Society "Hipparchos".

Publications in International Journals with Referees

1. Harsoula M., Efthymiopoulos C. and Contopoulos C, 2016, "Analytical forms of chaotic spiral arms", *Mon. Not. R. Astron. Soc.*, 459, 3419
2. Delis N. and Contopoulos G., 2016, "Analytical and numerical manifolds in a symplectic 4-D map", *Cel. Mech. Dyn. Astron.*, 126, 13
3. Tzemos A. C., Contopoulos G. and Efthymiopoulos C., 2016, "Origin of chaos in 3-d Bohmian trajectories", *Phys. Lett. A*, 380, 3796
4. Kyziropoulos P., Efthymiopoulos C., Gravannis G. and Patsis P., 2016, "Structures induced by companions in galactic discs", *Mon. Not. R. Astron. Soc.*, 463, 2210
5. Lukes-Gerakopoulos G., Katsanikas M., Patsis P.A. and Seyrich J., 2016, "Dynamics of a spinning particle in a linear in spin Hamiltonian approximation," *Phys. Rev. D*, 94, 024024
6. Gkolias I., Celletti A., Efthymiopoulos C. and Pucacco G., 2016, "Theory of secondary resonances in the spin-orbit problem", *Mon. Not. R. Astron. Soc.*, 459, 1327
7. Paez R., Locatelli U. and Efthymiopoulos C., 2016, "New Hamiltonian expansions adapted to the Trojan problem". *Cel. Mech. Dyn. Astron.*, 126, 519
8. Gachet F., Celletti A., Pucacco G. and Efthymiopoulos C., 2016, "Geostationary secular dynamics revisited: application to high area-to-mass ratio objects". *Cel. Mech. Dyn. Astron.*, (in press)
9. Nathanail A., Strantzalis A. and Contopoulos I., 2016, "The rapid decay phase of the afterglow as the signature of the Blandford-Znajek mechanism", *Mon. Not. R. Astron. Soc.*, 455, 4479

10. Contopoulos I., 2016, "The Equatorial Current Sheet and other interesting features of the Pulsar Magnetosphere", *J. Plasma Phys. (Special Volume on Modern Plasma Processes)*, 82, 6303
11. Contopoulos I. G., Esposito F. P., Kleidis K., Papadopoulos D. B. and Witten L., 2016, "Generating solutions to the Einstein field equations", *Int. J. Mod. Phys. D*, 25, 1650022
12. Christodoulou D.M., Gabuzda D. C., Knuettel S., Kazanas D., Coughlan C. P. and Contopoulos I., 2016 "Dominance of Outflowing Electric Currents on Decaparsec to Kiloparsec Scales in Extragalactic Jets", *Astron. Astrophys.*, 591, 61
13. Contopoulos I., Kazanas D. and Papadopoulos D.B., 2016, "The Magnetic Rayleigh-Taylor Instability in Astrophysical Disks", *Mon. Not. R. Astron. Soc.*, 462, 565
14. Fukumura K., Tombesi F., Kazanas D., Shrader C., Behar E. and Contopoulos I., 2016, "Fast ionized X-ray absorbers in AGNs", *Astr. Nachr.*, 337, 454
15. Christodoulou D. M., Contopoulos I., Kazanas D., Steiner J. F., Papadopoulos D. B. and Laycock S. G. T., 2016, "On the Theoretical Framework of Magnetized Outflows from Stellar-Mass Black Holes and Related Observations", *Mon. Not. Roy. Astr. Soc.*, 461, 2650
16. Contopoulos I., 2016, "Are there two types of pulsars?", *Mon. Not. R. Astron. Soc.*, 463, L94
17. Paliathanasis A., Tsamparlis M., Basilakos S. and Barrow J. D., 2016, "Classical and quantum solutions in Brans-Dicke cosmology with a perfect fluid", *Phys. Rev. D.*, 93, 043528
18. Basilakos S., 2016, 'Linear growth in power law $f(T)$ gravity', *Phys. Rev. D.*, 93, 083007
19. Koutoulidis L., Plionis M., Georgantopoulos I., Georgakakis A., Akylas A., Basilakos S. and Mountrichas G., 2016, "Comparison of spatial and angular clustering of X-ray AGN", *Astron. Astrophys.*, 590, 23
20. Basilakos S., Mavromatos N. and Sola J., 2016, "Starobinsky-Like Inflation and Running Vacuum in the Context of Supergravity", *Universe*, 2, 14
21. Carvalho C.S. and Basilakos S., 2016, "Angular distribution of cosmological parameters as a probe of inhomogeneities: a kinematic parametrisation", *Astron. Astrophys.*, 592, 192
22. Terlevich R., Melnick J., Terlevich E., Chavez R., Telles E., Bresolin F., Plionis M., Basilakos S., Fernandez A. D. and Gonzalez M., 2016, "Direct measurement of

- lensing amplification in Abell S1063 using a strongly lensed high redshift HII galaxy”, *Astron. Astrophys.*, 592, L7
23. Kamali V., Basilakos S. and Mehrabi A., 2016, “Tachyon warm-intermediate inflation in the light of Planck data”, *Eur. Phys. J. C*, 76, 525
 24. Chavez R., Plionis M., Basilakos S., Terlevich R., Terlevich E., Melnick J., Bresolin F. and González-Moran A. L., 2016, “Constraining the dark energy equation of state with H II galaxies”, *Mon. Not. R. Astron. Soc.*, 462, 2431
 25. Malekjani M., Basilakos S., Mehrabi A., Davari Z. and Rezaei M., 2016, “A geographic dark energy: growth index and cosmological implications”, *Mon. Not. R. Astron. Soc.*, 464, 1192
 26. Basilakos S. and Nesseris S., 2016, “Testing Einstein’s gravity and dark energy with growth of matter perturbations: Indications for new Physics?”, *Phys. Rev. D.*, in press (arXiv:1610.00160)
 27. Papagiannopoulos G., Barrow J. D., Basilakos S., Giacomini A. and Paliathanasis A., 2016, “Dynamical symmetries in Brans-Dicke cosmology”, *Phys. Rev. D.*, in press (arXiv:1611.00667)
 28. Gontikakis C. and Vial J.-C., 2016, “Evidence of scattering effects influenced by plasma flows in C VI 1548 Å, 1550 Å spectral lines emitted from the Sun”, *Astron. Astrophys.*, 590, 86
 29. Syntelis P., Gontikakis C., Patsourakos S. and Tsinganos K., 2016, “The spectroscopic imprint of the pre-eruptive configuration resulting into two major coronal mass ejections”, *Astron. Astrophys.*, 588, 16
 30. Patsourakos, S., Georgoulis, M. K., Vourlidas, A. (+36 co-authors, among them Gontikakis C.), 2016, “The Major Geoeffective Solar Eruptions of 2012 March 7: Comprehensive Sun-to-Earth Analysis”, *Astrophys. J.*, 817, 14
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38. Georgoulis M. K., Papaioannou A., Sandberg I., Daglis I. A., Anastasiadis A., Rodriguez-Gasen R., Aran A., Sanahuja B. and Nieminen P., 2017 "Analysis and Interpretation of Inner Heliospheric SEP Events with the ESA Standard Radiation Environment Monitor (SREM) Onboard the Integral and Rosetta Mission", *J. Space Weath. Space Clim.*, in press
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42. Zhang Z-Y, Papadopoulos P. P., Ivison R. J., Galametz M., Smith M.W.L. and Xilouris E.M., 2016, "Gone with the heat: a fundamental constraint on the imaging of dust and molecular gas in the early Universe", *Roy. Soc. Op. Sc.*, 3, 160025
43. Georgoulis M. K., 2017, "The Ambivalent Role of Field-Aligned Electric Currents in the Solar Atmosphere", Invited Review in *Electric Currents in Geospace and Beyond* (A. Keiling, M. Octav, & M. Wheatland, Editors), AGU Monograph Ser., in press

Publications in Greek

1. "Mathematical study of chaos", G. Contopoulos, M. Harsoula and C. Efthymiopoulos, *Proceedings of the Academy of Athens*, 2016
2. "The future of Computers", G. Contopoulos, A. C. Tzemos, journal "Aktines", 760, pages 203-214 (November-December 2016)

Participation in Conferences and Talks

G. Contopoulos

- GC-1. Participation in the international conference: "Computational perturbative methods for Hamiltonian systems - Applications in physics and Astronomy", that took place in Athens (July 11-13) and was organised from the University Tor Vergata of Rome and RCAAM of the Academy of Athens. Invited Talk: "The History of the Third Integral (A personal account)".
- GC-2. Participation of Dr. A.C. Tzemos in the international summer school of Physics Enrico Fermi (scholarship) that took place in Varenna (Italy), with title "Foundations of Quantum Mechanics" and presentation of results in a poster with title "The mechanism of Chaos in 3-d Bohmian Trajectories", Tzemos A.C., Contopoulos G. and Efthymiopoulos C.

P. Patsis

- PP-1. Participation in the international conference: "Formation and evolution of galaxy outskirts" IAU Symposium 321, Toledo, Spain, March 14-18. Poster presentation with title: "Outer spiral structure in disk galaxies".
- PP-2. Participation in the 11th international conferences in Analytical Mechanics "H-STAM, INTERNATIONAL CONGRESS ON MECHANICS", Athens, May 2016. Talk: "Periodic solutions and the structure of phase space in autonomous Hamiltonian systems. Just a chicken-egg situation?"
- PP-3. Invited talk in the Max-Planck Institut fuer Astrophysik with title "Comparing Gaseous and Stellar Flows in the Spiral Arms of barred-spiral models" (July 11).
- PP-4. Participation in the international conference: "Discs in Galaxies", ESO, Garching bei Muenchen, Germany, July 11-15. Two poster presentations: 1. with title: "Gaseous and stellar flows in the spiral arms of barred-spiral models" and 2. with title "Estimates of the strength of spiral perturbations in disk galaxies" (with P. Grosbol).
- PP-5. Participation in the international conference European Week of Astronomy and Space Science-EWASS 2016, member of the local organising committee, Athens, Evgenideio Foundation, July 4-8, Talk in Special Session 6, "The life and times of the Milky Way bulge", with title "X-shape bulges and the dynamical mechanisms behind them".

C. Efthymiopoulos

- CE-1. "Impact of companions on galactic discs: simulations by the new N-body code MAIN". Invited talk in the seminar of the Department of Electrical Engineering of the University of Thrace (January 2016).
- CE-2. Participation in the 11th international conference on Analytical Mechanics H-STAM, INTERNATIONAL CONGRESS ON MECHANICS, Athens, May 2016. Talk: "The book-keeping method of canonical perturbation theory and its applications" .
- CE-3. Participation in the international conference "FQXI Workshop on Quantum Rogue Waves as Emerging Quantum Events", Aix-Marseille, Γαλλία, June 2016. Invited talk "Mechanisms of Bohmian Chaos and the rate of quantum relaxation".
- CE-4. Participation in the international conference Computational perturbative methods in Hamiltonian systems - applications in physics and astronomy, Athens, July 2016. Ομιλία: "Computational Hamiltonian Perturbation theory: prospects and challenges".
- CE-5. "Analytical Study of the secular dynamics of geosynchronous space debris" Invited talk in the seminar of the Department of Mathematics of the University of Padova Μαθηματικού Τμήματος του Παν/μίου της Πάντοβα (October 2016).
- CE-6. "Tidal Evolution in the Solar System" Invited talk in the masters program of the Department of Mathematics of the University of Padova (October 2016).
- CE-7. Participation in the international conference Final StarDust Conference, ESA-ESTEC, Netherlands, November 2016, Invited talk "Applications of Canonical Perturbation Theory in Problems of Resonance: the case of space debris"
- CE-8. "Effects of in-falling companions on galactic discs». Invited talk in the Stellar Astrophysics Center, University of Aarhus, Denmark, December 2016.

I. Contopoulos

- IC-1. "Numerical simulations of industrial processes", Invited talk in the National Polytechnical University, Department of Chemical Engineering, masters program of computational mechanics Masters programma of Computational Mechanics, March 1.
- IC-2. Participation in the international conference 2nd Purdue Workshop on Relativistic Plasma Astrophysics, Purdue University (Lafayette, IN, USA), May 9-11. Invited talk "The Equatorial Current Sheet and other interesting features of the Pulsar Magnetosphere".

- IC-3. Participation in the international conference Workshop on the Physics of Pulsar Magnetosphere, NASA/Goddard Space Flight Center (Greenbelt, MD, USA), June 6-8. Invited talk "The Aristotelian Equatorial Current Sheet".
- IC-4. Participation in the international conference European Week of Astronomy and Space Science-EWASS 2016, Symposium 11, Evgenideio Foundation (Athens, July 4-8, Invited talk "The signature of the Blandford-Znajek mechanism in GRB light curves".
- IC-5. In the same conference (IC-5), Invited talk "Dissipative Pulsar Magnetospheres".

S. Basilakos

- SB-1. He was invited to visit the Department of Physics of the University of Cyprus (27/3-02/04/2016), where he gave a lecture with title 'Cosmological Geome-trodynamics'.

C. Gontikakis

- CG-1. Participation in the meeting 3rd FLARECAST Full-Consortium Meeting, Genova, Italy June 27 – 28. Talk with title "Can DEM evolution calculated with SDO/AIA filters, predict solar flares ? "
- CG-2. Participation in the international conference European Week of Astronomy and Space Science-EWASS 2016, Symposium S17, Evgenideio Foundation (Athens), July 4-8, talk with title "Spectroscopic study of active region 11429 before the eruption of two CMEs", (with P. Syntelis and K. Tsinganos).
- CG-3. Presentation of J-C Vial in the AGU fall meeting December 12-14, St. Francis USA HPA, of the work of Vial, Gontikakis, with title : "From the observation of Non-symmetrical profiles of the C IV resonance lines for small dynamic events to their interpretation in terms of resonant scattering in solar active region".
- CG-4. Lecture for the postgraduate students of the University of Athens with title "Thermalisation of solar corona and the model of nanoflares" (23-5-2016).

M. Georgoulis

- MG-1. Work meeting 2nd FLARECAST Full-Consortium, Dublin, Ireland, January 14-15. Coordination of the meeting

- MG-2. Participation in the international conference ILWS Science Workshop: Science for Space Weather, Goa (January 23-29). Invited talk: "Performance Verification of Solar-Flare Prediction Models: from Climatology to Skill and from Forecast Probabilities to Certainty. Poster: Magnetic-Field Magnitude of CMEs: Near-Sun Value and Evolution to 1 AU".
- MG-3. Work meeting Annual Council Meeting of the European Physical Society (EPS), Toulouse, France, April 1-2, Representation of the Department of Solar Physics as President.
- MG-4. Participation in the international conference International Space Science Institute (ISSI) Workshop on Decoding the Pre-Eruptive Magnetic Configurations of Coronal Mass Ejections, Bern, Switzerland, April 4 – 8, Invited talk: "Pre-Eruption Magnetic Configuration of CMEs".
- MG-5. Participation in the international conference European Geosciences Union (EGU) 2016 General Assembly, Biévvη, Austria, April 17 – 22. Coorganiser of the meeting with title Progress in Space Sciences Fostered by the European Commission, talk with title The FLARECAST Project and What Lies Beyond.
- MG-6. Participation in the international conference ESA SSA Space Weather Service Network Thematic Workshop, Darmstadt, Germany, May 10-12. Invited talk: "The A-EFFort Flare Prediction Service at ESA/SSA SWE Portal".
- MG-7. Participation in the international conference American Geophysical Union (AGU) Chapman Meeting in Currents in Geospace and Beyond, Dubrovnik, Croatia May 23 – 27. Invited talk: "Electric Currents in the Solar Atmosphere".
- MG-8. Work meeting 50th ESA Science Programme Committee (SPC) Meeting, Madrid, Spain, June 21 – 22. National representative of ESA/SPC.
- MG-9. Work meeting 3rd FLARECAST Full-Consortium Meeting, Genova, Italy June 27 – 28. Coordinator of the meeting.
- MG-10. Participation in the international conference European Week of Astronomy and Space Science-EWASS 2016, Evgenideio Foundation (Athens), July 4-8. Organisation of the symposium with title Magnetic Helicity in Sun and Stars. Invited talk: "The Path of Certain Active Regions Toward Eruptions and Implications for Solar-Eruptions Forecasting". Talk with title "Critical Diagnostics of Solar Magnetism Enabled by Magnetic Helicity".
- MG-11. Participation in the international conference ISSI Workshop on Magnetic Helicity Estimations in Models and Observations of the Solar Magnetic Field, Bern, Switzerland, September 20 – 23. Invited talk: "Application of the CB Method on the Feng Chen, JL, and NOAA AR 10930 Cases". Talk with title "New Results of

the CB Method: Mutual- vs. Self- Helicity Terms and the Axial Magnetic Field Strength of CMEs”.

- MG-12. Participation in the international conference ISSI Workshop on Improving the Reliability of Solar Eruption Predictions to Facilitate the Determination of Targets-of-Opportunity for Instruments With a Limited Field-of-View, Βέρνη, Switzerland October 24 – 28, Coorganiser of the work meeting. Talk with title: “Open Questions in Solar Flare Understanding and Prediction”.
- MG-13. Participation in the international conference 13th European Space Weather Week (ESWW13), Ostand, Belgium, November 14 – 18. Coorganiser of one FLARECAST Team meeting and coorganiser of two more meetings.
- He gave the talks: Main (Keynote) talk with title: “Comparing Different Solar Flare Prediction Methods”. Invited talk με τίτλο: “The SSA SWE A-EFFort Service: Successes and Shortcomings of Operational Solar Flare Prediction”. Invited talk with title: “Introduction to FLARECAST”. Ομιλία με τίτλο: “FLARECAST Science: A Comprehensive Database of Solar Flare Predictors”. and presented the following electronic posters: Ηλεκτρονική αφίσα with title: “A New Methodology to Predict the Axial ICME Magnetic Field at 1 AU”. Electronic posters with title: “The ESA SSA/SWE A-EFFort Service”. Electronic posters with title: “FLARECAST: an Overview”.
- MG-14. Work meeting 4th ESA/JUICE Steering Committee Meeting, Brussels, Belgium, November 30 Νοεμβρίου. Participation through web conference as member of the Advisory Board of JUICE mission.
- MG-15. He participated in the following meetings as representative:
- European Physical Society Council Meeting, Toulouse, France, April 1 – 2 2016. Participation as president of the department of Solar Physics of the European Physics Association ESA Science Programme Committee Meeting 150, Μαδρίτη, Spain, June 21 – 22 2016. Participation as national representative of the Committee of Science of the european organisation JUICE Steering Committee Meeting, Brussels, Belgium, November 30 2016 (web conference). Participation as member of the Advisory Board for the JUICE mission of ESA
- MG-16. Invited talk “Solar Flare Prediction: Status and Science”, March 2, Department of Physics, University of Athens.
- MG-17. Invited seminar with title “A Scientist’s View of the ESA / PRODEX Programme”, July 13, Meeting for the PRODEX programm of ESA.
- MG-18. Lecture on Solar Physics to the undergraduate students, Department of Physics of the University of Athens with title «Elements of Solar Magnetism and Magnetic Instabilities in the Sun», December 12

- MG-19. Invited talk with title “A Scientist’s View of the ESA/PRODEX Programme” in a meeting organised by GSRT about the PRODEX program tou ESA (July 13).
- MG-20. Participation as national representative in ESA, during the visit of the new general director of ESA Dr. Johann Woerner in the Ministry of Education.
- MG-21. Participation as member of the association of the research stuff of the Academy of Athens in the discussion of greek research institutes for the Greek Institute of Research (ELIDEK), which took place in the Committee of Education of the Greek Parliament.
- MG-22. As the national representative in ESA/SPC he participated in: (a) meeting for the programs of ESA in the University of Thessaloniki (November 4), (b) meeting of representatives of GSRT for the development of national strategy for the meeting of country-members of ESA in November 11 2016 and (c) in various discussions in the Ministry of Education for the same reason.

M. Harsoula

- MH-1. Participation in the international conference: “Computational perturbative methods for Hamiltonian systems - Applications in physics and Astronomy”, that took place in Athens and was organised from the University Tor Vergata of Rome and RCAAM of the Academy of Athens.

Organisation of Conferences and Meetings

1. Dr. Patsis was member of the local organising committee of the international conference “European Week of Astronomy and Space Science-EWASS 2016”, Athens, Evgenideio Foundation, July 4-8
2. Computational Perturbative Methods for Hamiltonian Systems: Applications in Physics and Astronomy: Coorganisation by RCAAM and the Department of Mathematics of Unviersity of Rome Tor Vergata (Dexterus program). Dr. Efthymiopoulos was the chairman of the scientific comiittee and the local organising committee.
3. Dr. I. Contopoulos was member of the Scientific organising committees (SOC) of two symposia of the international conference “European Week of Astronomy and Space Science-EWASS 2016”, Athens, Evgenideio Foundation, July 4-8: Symposium 11: “Gamma-ray bursts: recent theoretical models and observations” Symposium 15: “Exploring pulsar formation, evolution and magnetic field: from low mass X-ray binaries to magnetars”

4. Dr. Basilakos was member of the organising committee of the international summer school in Astrophysics: "Hot spots in the XMM sky: Cosmology from X-ray to Radio", June 15-18 louvíou.
5. Dr. Basilakos was member of the organising committee of the international of the international conference of Gravity: "Recent Development in Gravity NEB17", September 19-22, Mykonos. Dr. Georgoulis organised (or coorganised) the following meetings and symposia:
 - Progress in Space Sciences Fostered by the European Commission, 2016 EGU General Assembly, Vienna, Austria, April 17 – 22 (coorganiser).
 - Member of the organising committee of the international conference "European Week of Astronomy and Space Science-EWASS 2016", Athens, Evgenideio Foundation, July 4-8
 - Magnetic Helicity in Sun and Stars: from Dynamo Action to Eruptive Phenomena, Symposium of the 2016 EWASS, Athens, July 4 – 8 2016 (coorganiser).
 - Flares, Coronal Mass Ejections, and Solar Energetic Particles: Space Weather Impact, ESWW13, Ostand, Belgium, November 14 – 18 2016 (coorganiser).
 - Best Practice in Transitioning Existing Space Science Tools to Operational SW Prediction Systems, ESWW13, Ostand, Belgium Βέλγιο, November 14 – 18 2016 (coorganiser).

Moreover he organised the follow meetings:

- 2nd FLARECAST Full-Consortium Meeting, Dublin , Irland January 14-15 2016 (organiser, as scientific coordinator).
 - 3rd FLARECAST Full-Consortium Meeting, Genova, Italy, June 27-28 2016 (organiser, as scientific coordinator).
 - 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, October 24 – 28 2016 (organiser).
 - FLARECAST Project Management Board Meeting, as part of the SWW13, Ostand, Belgium, November 14-15 2016 (organiser, as scientific coordinator).
6. Dr. Harsoula was member of the local organising committed of the international conference "Computational perturbative methods for Hamiltonian systems Applications in physics and Astronomy", Athens, July 11-13 2016.

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

ΠΙΝΑΚΑΣ ΟΜΙΛΗΤΩΝ 2016

George Contopoulos Academy of Athens	The History of Orbits (A Personal Perspective)	12/1/2016
Naoum Bakalis NHRF	The need, benefits, and demonstration of a minimization principle for excited quantum states	19/1/2016
Savvas Nesseris Institute of Theoretical Physics, Madrid	The Dark Side of the Universe and Cosmological Observations	26/1/2016
Basileios Kostantoudis NCSR Demokritos	Non linear dynamics and morphoclastic Geometry in nanotechnology	2/2/2016
Joan Solà University of Barcelona	Running Vacuum in the Universe: hints of cosmological physics beyond the Λ CDM	9/2/2016
Kleomenis Tsiganis AUT	Is there a 'ninth planet' in the solar system?	16/2/2016
Ioannis Kontogiannis RCAAM	Solar Active Region Properties as Flare Predictors	23/2/2016
Christos Efthymiopoulos RCAAM	The effect of companions on galactic discs - a study via the newly developed N-Body code MAIN	1/3/2016
Nektarios Vlahakis UOA	Perturbing relativistic, magnetized jets: instabilities, and the interaction with the environment	8/3/2016
Claudia Cicone E.T.H. Zürich	Massive molecular outflows and AGN feedback	15/3/2016
Konstantinos Kokkotas University of Tübingen	Gravitational Waves - Detection and Prospects	22/3/2016
Ioannis Golias University of Rome Tor Vergata	The theory of secondary resonances in the spin-orbit problem	29/3/2016

George Contopoulos Academy of Athens	The Nature of Reality	5/4/2016
Spiros Basilakos RCAAM	Geometrodynamics and Cosmology	12/4/2016
Hélène Courtois University of Lyon	Presentation of the project: "Cosmic Flows"	21/4/2016
Panos Patsis RCAAM	Comparing Stellar and Gaseous Flows in the Spiral Arms of Barred-Spiral Models	10/5/2016
Constantinos Gontikakis RCAAM	Scattering effects in the spectral lines of the ionized carbon C IV1548,1550 Angstrom, emitted by the solar transition region	17/5/2016
Ioannis ContopoulosΚοντόπουλος RCAAM	Dissipative pulsar magnetospheres	24/5/2016
George Lukes-Gerakopoulos University of Prague	How to detect deterministic chaos in gravitational waves	31/5/2016
Christos Efthymiopoulos RCAAM	Realistic analytical modelling of the long-term orbital dynamics in the Geostationary Earth Orbit domain	7/6/2016
Anastasios Bountis University of Patras	Invertible Maps, the Parametrization Method and Breathers in KG Lattices	14/6/2016
Mirella Harsoula RCAAM	Analytical forms of chaotic spiral arms in barred-spiral galaxies	21/6/2016
Sofia Lianou University of Paris	Dwarf Galaxy Evolution: Within and around	28/6/2016
Piyali Chatterjee Indian Institute of Astrophysics	Severe Space weather: How the Sun produces Homologous and Cannibalistic Coronal Mass Ejections (CME)	5/7/2016

Victor Debattista University of Lancashire	Understanding the trends in the Milky Way's bulge	7/7/2016
Constantinos Calapotharakos Πανεπιστήμιο Maryland, NASA	Macroscopic and Kinetic Pulsar Magnetosphere Models in the FERMI Era	19/7/2016
Eugene Vasiliev Oxford University	Self-consistent galaxy models with action-based distribution functions	22/9/2016
George Lukes-Gerakopoulos University of Prague	Spinning test-body orbiting around Schwarzschild black hole: circular dynamics and gravitational-wave fluxes	27/9/2016
Athanasios Tzemos RCAAM	3-d Bohmian Chaos	4/10/2016
Demetris Papadopoulos AUT	Rayleigh-Taylor Instabilities in Curved Space-Times	11/10/2016
Ioannis Kontogiannis RCAAM	Non-neutralized currents and Ising energy predictive potential on solar flares	25/10/2016
Athina Pouri RCAAM	Testing General Relativity on cosmological scales using Large Scale Structure and the Growth Rate Data	1/11/2016
Evaggelia Athanassoula L.A.M.	Numerical simulations of the formation of disc galaxies in major mergers	8/11/2016
Vasileios Tritakis RCAAM	Construction and Development of a Permanent Station for Schumann Resonance Observations, in the Greek Area. First Results and Future Plans.	15/11/2016
Charis Skokos Πανεπιστήμιο Cape Town	Numerical tools for investigating the dynamics of Hamiltonian systems	22/11/2016

Kostas Florios RCAAM	Forecasting solar flares using magnetogram-based predictors and machine learning	29/11/2016
Athanasios Akylas NOA	Compton-thick AGN in the 70-month Swift-BAT All-Sky Hard X-ray Survey	6/12/2016
Manolis Ksilouris NOA	Nearby galaxies as seen by the Herschel Space Observatory	13/12/2016

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 2015-2016 and 2016-2017 (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. Moreover he made three lectures in the framework of the postgraduate lesson “Special topics of Complexity” which is coorganised by National Polytechnical University and the network COSA of NCSR Demokritus.
- **Dr. Basilakos** taught the lesson of Cosmology (winter and spring semester of 2016) in the Mathematics and Physics Departments of UOA. During the winter semester of 2016 he taught Cosmology to postgraduate students of the Physics Department of UOA.
- **Dr. I. Contopoulos** made an educational seminar in the summer school of the Greek Astronomical Union, at the University of Athens (July 14) with title “The Launching of Jets from Astrophysical Accretion Disks and Black Holes”.
- **Dr. I. Contopoulos** made an educational seminar in the meeting of distinguished students of Gymnasium-Lyceum “Students meet Physics”, Hellenic Physical Society, TEI of Athens (December 17) with title “The magic of Physics and the struggle for domination in the 21th century”.
- **Dr. C. Gontikakis** and **Dr. M. Harsoula** organised with the help of members of RCAAM the exams for scholarships of the Academy of Athens for postgraduate studies abroad.

Phds and Masters

During 2016 there were 8 Phd students and postgraduate students. Moreover RCAAM researchers participate in other PhD supervision committees outside of RCAAM. Specifically, during 2016 RCAAM members supervised the PhDs of:

- E. Tsigaridi, "Nonlinear Phenomena in Response Models of Galactic Disks", (supervisor: Dr. P. Patsis, member of the examining committee: G. Contopoulos) (successful presentation in July 4)
- A. Nathanail, "The origin of magnetic fields in Astrophysics (supervisor: Dr. I. Contopoulos)(successful presentation in July 2016)
- A. Pouri, (scholar of the Academy of Athens), "The study of the nature of dark energy using extra-galactic high energy sources" (supervisor: S. Basilakos). (successful presentation in September 2)
- P. Syntelis, "Magnetic flux emergence in the Sun, Solar jets and Coronal Mass Ejections" (supervisor Dr. C. Gontikakis) (successful presentation May 13)
- E. Koutsantoniou, "Cosmic battery in accretion discs around astrophysical black holes" (supervisor: Dr. I. Contopoulos)

and the Masters of:

- K. Dima, "The spiral structure of galactic discs and the determination of corotation with kinematic methods" (supervisor: Dr. P. Patsis). (successful presentation in June 24)
- E.M.Chrisafeli, "Fourier analysis of spiral galaxy models" (supervisor: Dr. P. Patsis). (successful presentation in September 16)
- F. Anagnostopoulos, "Study of the accelerating rhythm of expansion of the Universe" (supervisor: Dr. S. Basilakos)

All of the aforementioned persons 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. Patsis co-supervises the PhD of Magdalini Aggelakopoulou with title "Numerical and theoretical study of 3d Hamiltonian systems in Economics" (Department of Economics, University of Thessaly).

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. Basilakos supervises the PhD of I. Papagiannopoulos (UOA) with title "Study of symmetries in cosmologic models of alternative gravitation".

Dr. Georgoulis was invited examiner of the PhD of Aaron Reid with title «Ellerman Bombs: Explosive Photospheric Magnetic Reconnection» (Supervisor: Prof. Michalis Mathioudakis, Queens University Belfast, UK). Successful presentation in November 24.

Missions – Visits to other Research Institutions

1. Panos Patsis

He visited after invitation the Max-Planck Institut fuer Astrophysik and made a talk (PP-3)

2. Christos Efthymiopoulos

He visited after invitation the Department of Mathematics of the University of Padova from 1 to 31 of October 2016. He had scientific collaboration with Professors Massimiliano Guzzo and Antonio Ponno on the subject of weak chaotic diffusion in Hamiltonian systems with 3 degrees of freedom. (CE-5, CE-6)

3. Ioannis Contopoulos

He visited the Perdue University (Indiana, USA, March 2016) where he had collaboration with Prof. Dimitrios Giannios and gave an invited talk) (IC-2) He also visited the NASA/Goddard Space Flight Center (Maryland, USA, June 2016) where he had collaboration with the researchers Dr. D. Kazanas (corresponding member of the Academy of Athens) and Dr. C. Kalapotharakos and gave an invited talk. (IC-3)

4. Spiros Basilakos

He visited after invitation the Department of Physics, University of Cyprus, 27/3-2/4/2016, where he made a seminar (SB-1)

Incoming Visitors

- Professor D. Papadopoulos (AUT) visited RCAAM for collaboration with Dr. I. Contopoulos and made a seminar.

- Dr. P. Papadopoulos (School of Physics and Astronomy, University of Cardiff, UK) who has been elected as associative professor in the University of Thessaloniki was hosted at RCAAM Professor P. Papadopoulos has a collaboration with Dr. Patsis and Dr. Basilakos.

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: Short article in the newspaper "TO BHMA", December 24.
- C. Ehfthymiopoulos: Interactive Lesson "Ms. Gravity" at the 6th Elementary School of Camatero. Organisation of night observation with telescope at the same school. - Interactive Lesson "Man in Space" at the Youth Detention Center of Avlonas. - Interview at the radio station 89.5 of the Church of Greece. - Organisation of meeting for the public in collaboration with the cultural association Mad Waters of Chalkis and the state of Central Greece with title "Tides: From Euripus to Space".
- S. Basilakos: Article in the newspaper "TO BHMA", August 21.
- I. Contopoulos: 1 talk at the 2nd Elementary School of Glyfada, 1 talk at the Gymnasium of the Metropolis of Peiraus, 1 talk at Ralleio Elementary School.
- M. Georgoulis: 1 talk at the Youth Detention Center of Avlonas, 1 talk at the municipality of Elefsina, 1 talk for the "Nights for the public" at Gerostathopouleio Observatory of the University of Athens. He supported a financial proposal for the construction of a planetarium in the island of Chios. Dr. Georgoulis was interviewed for his research activities in the newspaper "Ethnos" (March 3). His research was mentioned in 3 electronic articles (alithia.gr and 2 in Ellines.com). There were also many references in international websites regarding his activities in the frame of the FLARECAST program. Two press conferences about the prediction of solar flares were published in the website of the Academy of Athens and in the news.gr. He was interviewed in the

peripheral radio stations Radio1.gr (Salonica) και "ΑΛΗΘΕΙΑ Radio" (Northern Aegean). Finally he was interviewed for the programmes A-EFFort και FLARE-CAST in the tv station ALPHA.

- M. Harsoula: 1 talk in the meeting "Tides. From Euripus to Space".
- V. Tritakis: 1 talk in the "Εταιρεία Φίλων του λαού" association.