



UNIVERSITY OF CRETE  
DEPARTMENT OF PHYSICS  
SECTION OF ASTROPHYSICS & SPACE PHYSICS  
ANNUAL REPORT FOR 2011

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*Image Credit of Cover Page*

*Top: View of the Skinakas summit with the telescope domes and the housing quarters (see Sect. 3.1).*

*Middle: The receiving antennae of the SESCAT experiment near Chania (see Sect. 3.2).*

*Bottom: The 1.3m telescope of Skinakas Observatory inside its dome (see Sect. 3.1).*

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## 1. INTRODUCTION

The present document summarizes the activities of the members of the Section of Astrophysics and Space Physics at the Department of Physics of the University of Crete, during the 2011 calendar year. The staff of the Section consisted of 13 PhD research scientists, 6 graduate students and 4 technicians. Members of the Section were involved in teaching undergraduate and graduate courses at the University of Crete, while doing research in the fields of Theoretical and Observational Astrophysics, as well as in Atmospheric and Ionospheric Physics. Their research has been funded by national and international research grants, and in 2011 it resulted in 42 papers published in refereed journals, that is  $\sim 3.2$  papers per PhD researcher. Significant efforts were also devoted in the operation and improvement of the infrastructure and hardware at Skinakas Observatory and the Ionospheric Physics Laboratory. This document was prepared in January 2012, based on contributions from all members of the Section. The final editing was done by V. Charmandaris.

## 2. PERSONNEL

### 2.1. PERSONNEL OF THE SECTION

The staff associated with the Section of Astrophysics and Space Physics consists of 13 PhD research scientists, 4 PhD students, 5 Masters students, and 4 technicians.

The 7 Physics faculty members of the Section during the whole period of the report were Vassilis Charmandaris (Assoc. Prof.), Christos Haldoupis (Prof.), Nikolaos D. Kylafis (Prof.), John Papamastorakis (Emeritus Prof.), Iossif E. Papadakis (Assoc. Prof.), Ilias M. Vardavas (Assoc. Prof.) and Andreas Zezas (Assist. Prof.). Pablo Reig (Researcher B' at the Foundation for Research and Technology – Hellas) and Fotis Mavromatakis, (Assist. Prof. at the Technical Educational Institute of Heraklion) were also affiliated with the Section. Researchers in non-tenure track positions holding a PhD degree were Dr. Maria Caballero-García, Dr. Omaira González-Martín, Dr. Tanio Díaz-Santos, and Dr. Fabrizio Nicastro. Support staff associated with the Skinakas Observatory were Mr. Anastasios Kougentakis, Dr. Eythymios V. Paleologou, Mr. George Paterakis, and Ms. Anna Stiakaki.

PhD students during this period were Nikos Benas (with I. Vardavas), Theodore Bitsakis (with V. Charmandaris), Paolo Bonfini (with A. Zezas), and Grigoris Maravelias (with A. Zezas). Master's students were Evaggelia Koutra (with A. Zezas), Alexadros Maragoudakis (with A. Zezas), Alexadros Psychogios (with V. Charmandaris) and Maria Tsantaki (with A. Zezas). In September 2011 Fani Dosopoulou and Stergios Kyanidis commenced the 2011-2012 Master's program in Astrophysics.

### 2.2. PERSONNEL CHANGES

Dr. N. Brassington, Dr. M. Caballero-García, Dr. T. Díaz-Santos, and Dr. O. González-Martín completed their postdoctoral appointment and moved to the University of Hertfordshire (UK), Univ. of Milano (Italy), California Institute of Technology (USA), and Instituto Astrofísica de Canarias (Spain) respectively. Dr. F. Nicastro moved back to Rome Observatory (Italy). In March 2011, Dr. Kostas Tassis (JPL/Caltech, USA) was elected as an Assistant Professor of Theoretical Astrophysics. He will join the group in the fall of 2012.

## 2.3. GRADUATING STUDENTS

Mr. Alexadros Psychogios obtained his Masters in Advanced Physics with specialty in "Astrophysics and Space Physics" in March 2011. His Masters thesis, performed under the supervision of Prof. Charmandaris, was entitled "UV and Infrared Properties of Luminous Infrared Galaxies".

Ms. Maria Tsantaki obtained her Masters in Advanced Physics with specialty in "Astrophysics and Space Physics" in March 2011. Her Masters thesis, performed under the supervision of Prof. Zezas, was entitled "Ultra-luminous X-ray sources in the most metal poor galaxies". Ms Tsantaki is currently working towards her PhD at the Univ. of Porto, Portugal.

Ms. Evagelia Koutra obtained her Masters in Advanced Physics with specialty in "Astrophysics and Space Physics" in July 2011. Her Masters thesis, performed under the supervision of Prof. Zezas, was entitled "A study of X-Ray sources population in Wolf-Rayet galaxies".

Mr. Alexandros Maragoudakis obtained his Masters in Advanced Physics with specialty in "Astrophysics and Space Physics" in November 2011. His Masters thesis, performed under the supervision of Prof. Zezas, was entitled "A study of X-Ray sources population in Wolf-Rayet galaxies".

## 3. FACILITIES

### 3.1. SKINAKAS OBSERVATORY

The Skinakas Observatory operates as part of a scientific research collaboration between the University of Crete and the Foundation for Research and Technology-Hellas (FORTH<sup>1</sup>). Faculty and staff of the Section using the facilities of Skinakas, are also affiliated members of the Institute of Electronic Structure and Laser (IESL<sup>2</sup>) of FORTH. IESL provides additional hardware and logistics support towards the research of the members.

On Sunday May 29th 2011 Skinakas Observatory celebrated its 25 years of successful operations. During this period the Observatory kept updating its high quality instrumentation, trained numerous undergraduates and graduates students of the University of Crete, and presented the wonders of the night sky to thousands of visitors. Furthermore, researchers from Greece and abroad have published 107 refereed papers using data from its facilities. More information on the event is available at:

<http://skinakas.physics.uoc.gr/en/25years>

The Observatory currently has two fully operating telescopes. One is a Modified Ritchey-Chrétien telescope with a 1.3 m aperture (focal ratio of f/7.6), which was built by DFM Engineering and Zeiss and became operational in 1995. The second is a 0.6 m Cassegrain telescope (focal ratio of f/8) owned by the University of Tübingen (Germany) and co-operated with the Univ. of Crete, which is remotely controlled in a robotic mode via the web. A third 30 cm telescope (focal ratio f/3.2) is also available

<sup>1</sup> For more information on FORTH visit: <http://www.forth.gr>

<sup>2</sup> For more information on IESL visit: <http://www.iesl.forth.gr>

and was used in a few projects during the 2011 observing season. A number of modern instruments are permanently available on the 1.3 m telescope. These include several optical CCD cameras with complete filter sets, a long slit optical spectrograph, a high resolution ( $R=38,000$ ) echelle spectrograph, as well as a near-IR wide field camera.

In December 2011 Skinakas Observatory, the California Institute of Technology (USA), the Inter-University Center for Astronomy and Astrophysics (India), the Max-Planck Institute for Radio Astronomy (Germany), and the Nicolaus Copernicus University (Poland) signed an agreement for the design and construction of an optical polarimeter. The polarimeter will be mounted on the 1.3 m telescope of Skinakas Observatory in 2012, for a period of 3 years. The main scientific aim of this collaboration is the study of optical polarization of AGN and other transients.

The main projects during the 2011 April-to-November observing period were:

- ❑ Photometry and Spectroscopy of Planetary Nebulae and SNe Remnants.
- ❑ Photometry and Spectroscopy of Binaries with a compact star companion.
- ❑ Near-infrared observations of HMXB
- ❑ Near-infrared observations of Hickson Compact Groups
- ❑ High speed photo-polarimetry of optical GRB afterglows and X-ray binaries (HMXR, microquasars)
- ❑ Fast Photometry of cataclysmic variables

The High Time Resolution OPTIMA Instrument ("OPTIMA BURST"<sup>3</sup>) of the Max-Planck Institut für Extraterrestrische Physik was in operation at the 1.3 m telescope for the months of June and July 2011.

The tradition of "open nights" continued and the Observatory was open to the public for five nights during the 2011 observing season.

More details on Skinakas Observatory, the quality of the site, the telescopes, and the available instrumentation can be found in its recently updated web page at: <http://skinakas.physics.uoc.gr>

### 3.2. IONOSPHERIC PHYSICS LABORATORY

The Ionospheric Physics Laboratory (IPL), in collaboration with Stanford University, continued the un-interrupted operation of a narrow-band very low frequency (VLF) receiver experiment throughout 2011, and maintained its VLF database. This experiment is used for studying VLF signatures and propagation effects in the lower ionosphere during times of intense atmospheric electrical activity and the occurrence of transient luminous events (sprites and elves) in the upper atmosphere. Also, IPL operates, in collaboration with the Eötvös-Lenard Budapest University, a second automatic VLF receiver system on a routine basis side by side with the Stanford receiver in the rooftop of the Physics Building. In 2011, a new GPS (Global Positioning System) receiver station was set up in Crete (in collaboration with the Université de Rennes, France) for continuous monitoring of the ionospheric variability by measuring total electron content (TEC) and S4 index changes.

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<sup>3</sup> For more information on "Optima" visit: <http://www.mpe.mpg.de/OPTIMA>

## 4. COURSES

A number of elective undergraduate and graduate courses, directly related to the research areas covered by the Section, were offered as part of the teaching responsibilities of the faculty members. For the calendar year 2011 these were:

- ❑ SPRING SEMESTER 2011
  - "Astrophysics II"
  - "Astrophysics III"
  - "Observational Astrophysics"
  - "Production and Transfer of Radiation"
- ❑ FALL SEMESTER 2011
  - "Astrophysics I"
  - "Atmospheric Environment"
  - "Evolution of Planetary Atmospheres"
  - "Reduction and Analysis of Astronomical Observations"
  - "Observational Cosmology"
  - "Physics of Galaxies"

## 5. SCIENTIFIC RESEARCH

Here we present a brief description of the major research projects in which members of the Section were involved in 2011. These are grouped by research area and the scientists associated with each project are indicated in parentheses.

The scientific publications that resulted from this work, over the same period, are presented at the end of the report in section 12.

### 5.1. THEORETICAL ASTROPHYSICS

- ❑ Black holes as X-ray sources: Modeling of the spectral states of black-hole X-ray binaries in order to explain their energy spectrum (from radio to X-rays) and the intricate time variability of their intensity. Compton up-scattering of soft photons in the jet seems to be the mechanism for producing the hard X-ray spectrum and the variability observed. Time delays of the optical and the infrared with respect to the X-rays have been computed in accordance with the observations. (Researchers involved: N. Kylafis, P. Reig).
- ❑ Anomalous X-ray pulsars: Extremely interesting observations have been made recently on the hard X-ray spectrum of Anomalous X-ray Pulsars (AXPs). The hard X-rays have luminosity comparable to that of the soft X-rays and it is pulsed, with the rotational period of the neutron stars involved. In addition, the pulse fraction of the hard X-rays increases with the energy of the photons and it becomes  $\sim 100\%$  at  $\sim 100$  keV. A model to explain all of the above, plus the pulsed radio emission observed in some of them, has been worked. A paper was published in 2010 and a second one was submitted for publication. (Researcher involved: N. Kylafis, A. Zezas).
- ❑ Astrostatistics: Application of statistical methods in astrophysical problems. Recent projects include: derivation of star-formation histories from colour-magnitude diagrams, analysis of data taking into account calibration

uncertainties, derivation of spectral parameters from X-ray hardness ratios (Researcher involved: A. Zezas as member of the California/Harvard/ASC Astrostatistics Collaboration).

## 5.2. OBSERVATIONAL ASTROPHYSICS

### 5.2.1. OBSERVATIONAL GALACTIC ASTROPHYSICS

- ❑ X-ray variability of X-ray binaries (XRB): XRB consist of a compact star (neutron star or black hole) orbiting a regular star. When part of the material from the optical companion is accreted on the compact object the system brightens in X-rays. Hard X-ray observations provide a valuable probe of the emission region near the compact object. The goal here is to study their spectral and timing properties. The results from the spectral analysis of the RXTE data from the 2005/2006 outbursts of GX 339-4 were finally published in MNRAS, while we plan to submit soon, early next year, the results from the timing analysis of the outburst data of the GRO J1655 (Researchers involved: P. Reig, I. Papadakis, M. Sobolewska).
- ❑ Optical/IR monitoring of Be/X-ray binaries (BeX): BeX consist of a neutron star orbiting a O9e-B2e main-sequence star. The letter "e" stands for emission, as instead of the normal photospheric absorption lines the optical spectra of Be stars display emission lines. Strong infrared emission is another defining characteristic of Be stars. The origin of these two observational properties (emission lines and infrared excess) resides in a gaseous, equatorially concentrated circumstellar disc around the OB star. This disc constitutes the main source of variability in BeX and the fuel that powers the X-ray emission through accretion. The main objective of this project is to characterize the optical/IR variability time scales of Be/X-ray binaries in correlation with their X-ray activity. Another goal of this project is to investigate the effects of the compact object on the structure and evolution of the circumstellar envelope. One of the most interesting effects is the truncation of this envelope by the neutron star. In this project we wish to find observational evidence of such a truncation (Researchers involved: P. Reig, A. Zezas).
- ❑ Search for non-radial pulsations in Be/X-ray binaries: One of the unsolved issues regarding the physics of Be stars is the ultimate mechanism that originates the circumstellar disc. Rotation was identified as an important feature of the central star, and which may be a significant contributor to the generation of the circumstellar medium. There is no general consensus about whether Be stars rotate close to critical velocity (when the centrifugal force counterbalances the gravitational force at the equator) although the latest studies indicate that the mean rotation rate of Be stars is 70%-80% of the critical value. Rapid variability ( $< 3.5$  d) of B and Be stars can be explained as the consequence of non-radial pulsations or a rotational modulation. However, many studies support the notion that short-term photometric and spectroscopic variability is due to nonradial pulsation. The goals of this project are: i) to investigate the role of the nonradial pulsations in driving mass loss from Be stars, ii) compare the periods with those of Be/X in other galaxies and iii) compare the periods with those of isolated Be stars (Researchers involved: P. Reig)

- ❑ Study of the aperiodic variability of X-ray pulsars during giant outbursts. The main goal of this project is the definition and unified characterization of accretion-powered pulsar spectral states during giant outbursts. In the last twenty-five years, the discovery of different "states" in the X-ray emission of black-hole binaries (BHB) and neutron-star Low-Mass X-ray Binaries (LMXBs) constituted a large step forward in the understanding of the physics of accretion onto compact objects. While there are numerous studies on the timing and spectral variability of BHB and LMXBs, very little work has been done on High-Mass X-ray Binaries (HMXBs). We use both X-ray archived and new data of all the HMXBs displaying major outbursts to generate X-ray color-color and hardness-intensity diagrams to define possible spectral states. Subsequently, we obtain power density spectra and energy spectra to define the timing and spectral properties of those states. We search for correlation between the timing and spectral parameters. Such correlation will provide new insights (by constraining the models) into the accretion physics in HMXBs. (Researchers involved: P. Reig).

### 5.2.2. OBSERVATIONAL EXTRAGALACTIC ASTROPHYSICS

- ❑ Study of X-ray sources in the Small Magellanic Cloud: A study of the X-ray population in the Small Magellanic Cloud is underway, using Chandra observations of the central region of the Small Magellanic Cloud, dominated by a recent burst of star formation. Study of the optical counterparts and characterization of the star formation history in the specific areas of the Chandra sources has been conducted using optical imaging and spectroscopy with the 6m-Magellan Telescope, and the 4m-Anglo-Australian Telescope (2df). Moreover, XMM-Newton time has been awarded (end of 2008) to an international team (PI: Frank Haberl – MPE), of which D. Hatzidimitriou is a member, for the detailed study of the SMC X-ray binary population (Researchers involved: D. Hatzidimitriou, V. Antoniou, A. Zezas).
- ❑ X-ray source populations in nearby galaxies: Studies of the discrete X-ray source populations (in particular accreting sources) in nearby galaxies and their connection with their parent stellar populations (star-formation history, metallicity, etc) and star-cluster parameters. Studied objects cover the full spectrum of galaxies, ranging from dwarf-irregular star-forming galaxies to spiral and elliptical galaxies (Researchers involved: A. Zezas, P. Bonfini).
- ❑ Extragalactic supernova remnant populations: Multiwavelength studies of the supernova remnant populations in nearby galaxies using data from the Chandra X-ray observatory and narrow-band data from the Skinakas observatory. The goal of this project is to understand the populations of SNRs in different wavelengths in a variety of environments (Researchers involved: A. Zezas; this is the PhD project of I. Leonidaki (NOA, University of Patras)).
- ❑ X-ray variability studies of AGN: The work on the X-ray variability studies of AGN has been continuing during last year. The study of the spectral variability of the brightest radio quiet AGN in the Swift/BAT catalogue was completed and published. On the other hand, the results from the work on the comparison between the "rms-spectra", in the hard band, of nearby Seyfert galaxies, on short and long term time scales, although finalized, have not been submitted yet; we hope we will submit the paper in due course the coming year. In the meantime, new projects have been initiated, which focus on the study of the

variability properties of the iron line in bright Seyferts, the study of the "reverberation", negative time lags at high frequencies in a few AGN, using XMM-Newton data, and also on the study of the effects on the power-spectrum shape of variable absorbers in the hard band. Collaborative projects have also been initiated with colleagues in India (regarding the RXTE ASM data analysis of a large sample of blazars) as well as with colleagues in Italy, regarding the long term variability properties of high-z AGN. (Researchers involved: I. Papadakis).

- ❑ Multiwavelength studies of interacting galaxies: This is a comprehensive study of a large sample of interacting galaxies with the Spitzer Space Telescope and the Chandra X-ray Observatory. The goal of this study is to address the connection between galaxy interactions and induced star-formation and AGN activity (Researchers involved: A. Zezas).
- ❑ Mid- and Far-infrared properties of Luminous and Ultraluminous Infrared Galaxies (LIRGs/ULIRGs): This project was based on observations with the Spitzer Space Telescope in order to explore the mid-infrared properties of ULIRGs. The main goal is to improve our understanding of the dominant mechanism of the energy source (accretion onto an active nucleus or a super-massive starburst) in these galaxies and ascertain their role in galaxy evolution. There are various components of this project. One major component is the characterization of the mid- and far-infrared emission for a complete flux-limited sample of local LIRGs/ULIRGs, the Great Observatories All-Sky Survey (GOALS) galaxy sample, using the Spitzer and Herschel Space telescopes. In addition analysis of the role of LIRGs/ULIRGs at high redshift is being conducted based on data obtained with the Herschel Great Observatories Origins Deep Survey (H-GOODS). (Researchers involved: V. Charmandaris, T. Díaz-Santos).
- ❑ Star formation and stellar populations in Hickson Compact Groups: This project is based on mid-infrared observations of a sample of Hickson Compact Groups obtained with the Infrared Space Observatory and the Spitzer Space Telescope. Additional near-infrared imaging data of the Palomar 5m telescope, and Skinakas 1.3m telescope are being used in order to map in detail the star formation activity and old stellar population of these systems. The analysis is being extended to a larger sample of ~600 compact galaxy groups identified in the Sloan Digital Sky Survey, with ancillary data of GALEX and WISE (Researchers involved: T. Bitsakis, V. Charmandaris, T. Díaz-Santos).

### 5.3. ATMOSPHERIC & IONOSPHERIC PHYSICS

- ❑ Earth Observation and climate Project: Research work on Earth Observation and the Earth's Radiation Budget is an ongoing project. Modelling work of the radiation forcing of aerosols on a planetary scale includes the effects of aerosols on the solar ultraviolet, visible and near-infrared radiation reaching the Earth's surface. Model input data include satellite data from the NASA EOS satellites, Aqua and Terra. Ground-based data include the AERONET (Aerosol Robotic Network) site operated in Crete and provided by NASA Goddard. Climate research includes the effects of the El Nino phenomenon on the surface radiation budget over the tropical Pacific ocean. Collaboration with NASA Langley and the Meteorological Institute of the University of Munich on the heat budgets of enclosed seas, such as the Mediterranean, Black and Red seas is

ongoing.: (Researchers involved: I. Vardavas, N. Hatzianastassiou (Univ. of Ioannina), C. Matsoukas (Univ. of the Aegean), K. Pavlakis, A. Fotiadi, C. Papademas (Univ. of Ioannina)).

- ❑ Modelling the Evolution of Planetary Atmospheres Project: Research on modelling the evolution of planetary atmospheres has focussed on the development of a radiative/convective-photochemical-microphysical model for the global mean vertical atmospheric structure of the Precambrian Earth and of Titan. The Titan model has been validated against data from the recent Cassini/Huygens mission to Titan. A model for the formation of the haze layer that surrounds Titan has been developed. Work on the evolution of ultraviolet and XUV radiation of G-type solar like stars, which affects the atmospheric chemical composition of planets orbiting such stars, is ongoing with planned applications to exoplanets around G-type stars. (Researchers involved: I. Vardavas, P. Lavvas)
- ❑ Ionospheric and Upper Atmospheric Physics: The research topics under study relate to the plasma physics and electrodynamics of irregular ionospheric phenomena occurring at midlatitude, and problems associated with the interaction and coupling of the neutral mesosphere and lower thermosphere with the earth's ionosphere. During 2011 our research focused on the following topics : 1) the properties and mechanisms relating to the formation and destabilization of midlatitude sporadic E plasma layers (Es), and the role of wind shears and atmospheric tidal, gravity and planetary waves on sporadic E layer morphology and variability. 2) the effects on VLF (very low frequency) electromagnetic wave propagation and VLF response signatures associated with "transient luminous events", such as sprites, elves and gigantic jets, which are atmospheric electricity (thunderstorm and lightning) phenomena in the upper atmosphere and lower ionosphere; modelling the lifetimes of lightning-produced VLF perturbations, 3) meteor trail plasma instabilities and unusually long-lasting meteor echoes observed with VHF (very high frequency) and HF radars, 4) studies of ionospheric resonance phenomena observed in ultra low frequency (ULF) electromagnetic noise recordings with sensitive coil magnetometers, and 4) studies of the annual and seasonal variations of midlatitude sporadic E layers, and 5) Effects of X-ray solar flare events on the lower ionosphere using Arecibo radar incoherent scatter measurements. (Researchers involved: C. Haldoupis and international collaborators).

## 6. RESEARCH FUNDING

The following projects, funded by national and international agencies, enabled the research activities of the Section during the period of the report.

- ❑ EU funded FP7 Programme grant for the "Development of Space Astrophysics in Crete", (P.I.: N.D. Kylafis, budget: €1,120,000, duration: 2008-2011)
- ❑ Marie Curie International Reintegration Grant: (P.I.: A. Zezas, budget: €100,000, duration: 2008-2011)

## 7. COLLABORATIONS WITH OTHER INSTITUTES

Members of the group are actively collaborating with scientists affiliated with the following universities and research institutes:

- ❑ GREECE
  - Foundation for Research and Technology – Hellas (FORTH), Heraklion
  - National Observatory of Athens, Athens
  - Technical Education Institute of Crete, Dept. of Electrical Engineering, Heraklion
  - University of the Aegean, Dept. of Environment, Mytilene
  - University of Ioannina, Dept. of Physics, Ioannina
- ❑ INTERNATIONAL
  - California Institute of Technology, Spitzer Science Center, Pasadena, CA, USA
  - CEA/Saclay, Service d'Astrophysique, Paris, France
  - Cornell University, Astronomy Department, Ithaca, NY, USA
  - Eötvös-Lenard University, Budapest, Hungary
  - ETH, Zurich, Switzerland
  - Geophysical Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria
  - Harvard University, Center for Astrophysics, Cambridge, MA, USA
  - Hebrew University of Jerusalem, Jerusalem, Israel
  - Institut d'Astrophysique de Paris, France
  - Max-Planck-Institut für Extraterrestrische Physik, Garching, Germany
  - Max-Planck-Institut für Kernphysik, Heidelberg, Germany
  - NASA Goddard Space Flight Center, Greenbelt, MD, USA
  - NASA Langley Division of Atmospheric Sciences, Langley, VA, USA
  - Nicolaus Copernicus Astronomical Center, Warsaw & Torun, Poland
  - Northwestern University, Evanston, IL, USA
  - Observatoire de Paris, Paris, France
  - Oxford University, Oxford, UK
  - Rome Observatory, Rome, Italy
  - Shanghai Astronomical Observatory, Shanghai, China
  - Stanford University, Palo Alto, CA, USA
  - Université de Rennes, Rennes, France
  - University of Alicante, Alicante, Spain
  - University of Durham, Durham, UK
  - University of Napoli Federico, Napoli, IL
  - University of Saskatchewan, Canada
  - University of Southampton, Southampton, UK
  - University of Texas at Austin, Austin, TX, USA
  - University of Valencia, Valencia, Spain

## 8. NATIONAL & INTERNATIONAL COMMITTEES

During the period covered by this report, members of the Section were in a number of national and international committees. More specifically:

Prof. V. Charmandaris continued his duties as the Editor of the European Astronomical Society Newsletter (since 2005) and was appointed as substitute member of the Greek National Committee for Astronomy for the 2011-2013 term. He also served as a panel member of the 2011 Herschel Space Telescope Time Allocation Committee.

Prof. N. Kylafis is serving as the President of the Hellenic Astronomical Society for the 2010-2012 term, as well as the President of Greek National Committee for Astronomy for the 2011-2013 term. He is also Dean of the School of Sciences of the Univ. of Crete for the 2008-2012 term.

Prof. I. Papadakis is serving as the Secretary of the Hellenic Astronomical Society for the 2010-2012 term. He also served as a panel chair of the 2011 XMM/Newton Space Telescope Time Allocation Committee.

Prof. J. Papamastorakis completed his term as a substitute member of the Greek National Committee for Astronomy.

Dr. P. Reig was a member of the Scientific Organising Committee in the Be/X-ray Binary Workshop 2011, held in Valencia from 11-14 July 2011.

Prof. I. Vardavas is on the Editorial Board of the Environmental Modelling and Software Journal.

## 9. CONFERENCE & WORKSHOP ORGANIZATION

Prof. J. Papamastorakis was the chair of the organizing committee of the "Onassis Foundation Science Lecture Series", which take place at the premises of FORTH every summer. The lectures are principally sponsored by the Onassis Benefit Foundation and selected students from across Europe are financially assisted to attend. A Nobel laureate as well as other leading scientists in the same field, present intensive lectures to students for a week. Typically two and occasionally three lecture series are organized every summer since 2001. The 2011 lectures in Biology were addressing the topic of "Basic and Applied Virology" (see <http://www.forth.gr/onassis> ).

## 10. PUBLIC OUTREACH

All members of the Section are involved in a number of public outreach activities throughout the year. These consist of giving public lectures, mostly in the island of Crete, along with dedicated tours to the facilities of Skinakas Observatory, as well as TV and radio interviews. The group also supports the activities organized by the local amateur astronomy societies in Crete. During the 2011 calendar year a series of astrophotography exhibits were presented based on the book "Skinakas Observatory: a view to the Universe". The book, published at the end of 2010, was edited by Dr. E. Palaiologou and Prof. J. Papamastorakis presents a selection of breathtaking near-by and distant astronomical objects, imaged by the digital cameras of the telescopes at Skinakas Observatory, along with a brief description of their properties. Select pictures of the book were presented in the form of posters at the Eugenides Foundation in Athens (11-30 Apr. 2011), at the St. Marcus Basilica in Heraklion (12-30 Sep. 2011), as well as at Giali Tzamisi mosque in Chania (2-16 Nov. 2011).

## 11. VISITORS

A total of 15 scientists visited our Department during the 2011 calendar year in order to collaborate with staff members of the Section and/or give seminars. These individuals were: Dr. V. Antoniou (CfA, Harvard Univ., USA), Dr. S. Bianchi (3<sup>rd</sup> Univ. of Rome, Italy), Prof. A. Bourdillon (Univ. de Rennes, France), Dr. W. Brinkman (MPE-Garching, Germany), Prof. T. Courvoisier (Univ. of Geneva, Switzerland), Dr. D. Elbaz (CEA/Saclay, France), Dr. A. Fragkos (Northwestern Univ. USA), Dr. J. Gutierrez-Soto (Valencia International Univ., Spain), Prof. P. Kalas (Univ. of California, Berkeley, USA), Dr. O. King (Caltech, USA), Dr. V. Pavlidou (Caltech, USA), Dr. J.-L. Starck (CEA/Saclay, France), Prof. J. Trumper (MPE-Garching, Germany), Dr. K. Tassis (JPL, USA), Dr. F. Yurchikhin (Cosmonaut, Russia).

Furthermore, we hosted the visit of one undergraduate student, Mr Sandor-Iozsef Kruk from Univ. College London, (UK) during 17 August - 3 September 2011, and one post-graduate researcher Mr. Kostas Kaskavelis, from ESTEC-ESA (The Netherlands) from 1 August - 15 September 2011. The purpose of these visits was to be trained on the preparation, observation, reduction and analysis of astronomical campaigns. This fast-track training project took place in the facilities of the Skinakas observatory under the supervision of Dr. P. Reig.

## 12. PUBLICATIONS

The following 42 publications of the members of the Section appeared in print in international refereed journals (according to ISI/WoS) during the 2011 calendar year. This corresponds to ~3.2 refereed publications per PhD researcher. For each publication, the names of the members of the Section are underlined.

1. Ashby, M. L. N., Mahajan, S., Smith, H. A., Willner, S. P., Fazio, G. G., Raychaudhury, S., Zezas, A., Barmby, P., Bonfini, P., Cao, C., González-Alfonso, E., Ishihara, D., Kaneda, H., Lyttle, V., Madden, S., Papovich, C., Sturm, E., Surace, J., Wu, H., Zhu, Y.-N. "The Star Formation Reference Survey. I. Survey Description and Basic Data", 2011, PASP, 123, 1011
2. Babich, L., Haldoupis, Ch., Kudryavtsev, A., Kutsyk, I., "The effect of charge density in tropospheric thunderclouds on production of sprites and terrestrial gamma ray flashes", 2011, Journal of Geophysical Research, Vol. 116, Issue A9
3. Benas, N., Hatzianastassiou, N., Matsoukas, C., Fotiadi, A., Mihalopoulos, N., Vardavas, I., "Aerosol shortwave daily radiative effect and forcing based on MODIS Level 2 data in the Eastern Mediterranean (Crete)", Atmospheric Chemistry and Physics, Volume 11, Issue 7, 2011, pp.12647-12662
4. Bitsakis, T., Charmandaris, V., da Cunha, E., Díaz-Santos, T., Le Floc'h, E., Magdis, G., "A mid-IR study of Hickson compact groups. II. Multiwavelength analysis of the complete GALEX-Spitzer sample", 2011, A&A, 533, 142
5. Boquien, M., Lisenfeld, U., Duc, P.-A., Braine, J., Bournaud, F., Brinks, E., Charmandaris, V., "Studying the spatially resolved Schmidt-Kennicutt law in interacting galaxies: the case of Arp 158", 2011, A&A, 533, 19
6. Boselli, A., (and 53 coauthors including V. Charmandaris), "The GALEX Ultraviolet Virgo Cluster Survey (GUViCS). I. The UV luminosity function of the central 12 sq. deg", 2011, A&A, 528, 107
7. Buat, V., Giovannoli, E., Heinis, S., Charmandaris, V., Coia, D., Dasyra, K., Aussel, H., Altieri, B., Dannerbauer, H., Kartaltepe, J., Leiton, R., Magdis, G.,

- Magnelli, B., Popesso, P., "GOODS-Herschel: evidence of a UV extinction bump in galaxies at  $z > 1$ ", 2011, A&A, 533, 93
8. Civano, F., Brusa, M., Comastri, A., Elvis, M., Salvato, M., Zamorani, G., Capak, P., Fiore, F., Gilli, R., Hao, H., Ikeda, H., Kakazu, Y., Kartaltepe, J. S., Masters, D., Miyaji, T., Mignoli, M., Puccetti, S., Shankar, F., Silverman, J., Vignali, C., Zezas, A., Koekemoer, A. M., "The Population of High-redshift Active Galactic Nuclei in the Chandra-COSMOS Survey", 2011, ApJ, 741, 91
  9. Díaz-Santos, T., Charmandaris, V., Armus, L., Stierwalt, S., Haan, S., Mazzarella, J. M., Howell, J. H., Veilleux, S., Murphy, E. J., Petric, A. O., Appleton, P., Evans, A.S., Sanders, D.B., Surace, J.A., "The Spatial Extent of (U)LIRGS in the Mid-infrared. II. Feature Emission", 2011, ApJ, 741, 32
  10. Dopita, M. A., Armus, L., Kewley, L.J., Rich, J.A., Sanders, D., Appleton, P.N., Chan, Ben H. P., Charmandaris, V., Evans, A.S., Frayer, D.T., Howell, J. H., Inami, H., Mazzarella, J.A., Petric, A., Stierwalt, S., Surace, J., "Modeling IR spectral energy distributions: a pilot study of starburst parameters and silicate absorption curves for some GOALS galaxies", 2011, Ap&SS, 333, 225
  11. Elbaz, D., (and 53 coauthors including V. Charmandaris), "GOODS-Herschel: an infrared main sequence for star-forming galaxies", 2011, A&A, 533, 119
  12. Emmanoulopoulos, D., McHardy, I. M., Papadakis, I. E., "Negative X-ray reverberation time delays from MCG-6-30-15 and Mrk 766", 2011, MNRAS, 416, 94
  13. Emmanoulopoulos, D., Papadakis, I. E., McHardy, I. M., Nicastro, F., Bianchi, S., Arévalo, P., "An XMM-Newton view of the 'bare' nucleus of Fairall 9", 2011, MNRAS, 415, 1895
  14. Feroci, M., (and 202 coauthors including Kylafis, N., Papadakis, I., Reig, P., Zezas, A.), "The Large Observatory for X-ray Timing (LOFT)", 2011, Experimental Astronomy, DOI: 10.1007/s10686-011-9237-2
  15. González-Martín, O., Papadakis, I., Braitto, V., Masegosa, J., Márquez, I., Mateos, S., Acosta-Pulido, J. A., Martínez, M. A., Ebrero, J., Esquej, P., O'Brien, P., Tueller, J., Warwick, R.S., Watson, M.G., "Suzaku observation of the LINER NGC 4102", 2011, A&A, 527, 142
  16. González-Martín, O., Papadakis, I., Reig, P., Zezas, A., "The scaling of X-ray variability with luminosity in ultra-luminous X-ray sources", 2011, A&A, 526, 132
  17. Greiner, J. (and 67 co-authors including Kylafis, N.), "GRIPS - Gamma-Ray Imaging, Polarimetry and Spectroscopy", 2011, Experimental Astronomy, Doi: 10.1007/s10686-011-9255-0, pp. 91-120
  18. Haan, S., Armus, L., Laine, S., Charmandaris, V., Smith, J. D., Schweizer, F., Brandl, B., Evans, A. S., Surace, J. A., Díaz-Santos, T., and 6 coauthors, "Spitzer IRS Spectral Mapping of the Toomre Sequence: Spatial Variations of PAH, Gas, and Dust Properties in nearby Major Mergers", 2011, ApJS, 197, 27
  19. Haan, S., Surace, J. A., Armus, L., Evans, A. S., Howell, J. H., Mazzarella, J. M., Kim, D. C., Vavilkin, T., Inami, H., Sanders, D. B., Petric, A., Bridge, C. R., Melbourne, J. L., Charmandaris, V., Díaz-Santos, T., Murphy, E. J., U, V., Stierwalt, S., Marshall, J. A., "The Nuclear Structure in Nearby Luminous Infrared Galaxies: Hubble Space Telescope NICMOS Imaging of the GOALS Sample", 2011, AJ, 141, 100
  20. Haldoupis, Ch., "Midlatitude Sporadic E. A Typical Paradigm of Atmosphere-Ionosphere Coupling", 2011, Space Science Reviews, DOI: 10.1007/s11214-011-9786-8
  21. Hwang, H. S., Elbaz, D., Dickinson, M., Charmandaris, V., Daddi, E., Le Borgne, D., Buat, V., Magdis, G. E., Altieri, B., Aussel, H., Coia, D., Dannerbauer, H., Dasyra, K., Kartaltepe, J., Leiton, R., Magnelli, B., Popesso, P., Valtchanov, I.

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22. Jenkins, L. P., Brandt, W. N., Colbert, E. J. M., Koribalski, B., Kuntz, K. D., Levan, A. J., Ojha, R., Roberts, T. P., Ward, M. J., Zezas, A., "Investigating the Nuclear Activity of Barred Spiral Galaxies: The Case of NGC 1672", 2011, ApJ, 734, 33
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28. Nantais, J.B., Huchra, J.P., Zezas, A., Gazeas, K. Strader, J., "Hubble Space Telescope Photometry of Globular Clusters in M81", 2011, AJ, 142, 183
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31. Papadimas, C. D., Hatzianastassiou, N., Matsoukas, C.; Kanakidou, M., Mihalopoulos, N., Vardavas, I., "The direct effect of aerosols on solar radiation over the broader Mediterranean basin", Atmospheric Chemistry and Physics Discussions, Volume 11, Issue 11, 2011, pp.30009-30051
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33. Popescu, C. C., Tuffs, R. J., Dopita, M. A., Fischera, J., Kylafis, N. D., Madore, B. F., "Modelling the spectral energy distribution of galaxies. V. The dust and PAH emission SEDs of disk galaxies", 2011, A&A, 527, 109
34. Reig, P., Nespoli, E., Fabregat, J., Mennickent, R. E., "Multi-frequency observations of Swift J1626.6-5156", 2011, A&A, 533, 23
35. Reig, P., "Be/X-ray binaries", 2011, Ap&SS, 332, 1

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37. Sobolewska, M. A., Papadakis, I. E., Done, C., Malzac, J., "Evidence for a change in the X-ray radiation mechanism in the hard state of Galactic black holes", 2011, MNRAS, 417, 280
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In addition to the above the following refereed contributions to books were published:

1. Haldoupis C., "A tutorial review on Sporadic E layers", Chapter 29, in the book: Aeronomy of the Earth's Atmosphere-Ionosphere, Springer, 2011.

## 13. CONTACT

The Department of Physics of the University of Crete is located on a campus 8 km west of Heraklion, the largest city in the island of Crete, Greece. At the end of 2011 it consisted of 29 faculty members, as well as a number of research associates and graduate students, working on various fields of theoretical and experimental physics. The postal address of the Section of Astrophysics and Space Physics is:

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