



UNIVERSITY OF CRETE  
DEPARTMENT OF PHYSICS  
SECTION OF ASTROPHYSICS & SPACE PHYSICS  
ANNUAL REPORT FOR 2007

---

---

## TABLE OF CONTENTS

1. Introduction	1
2. Personnel	1
3. Facilities	2
3.1. Skinakas Observatory	2
3.2. Ionospheric Physics Laboratory	3
4. Courses	3
5. Scientific Research	4
5.1. Theoretical Astrophysics	4
5.2. Observational Astrophysics	4
5.2.1. Observational Galactic Astrophysics	4
5.2.2. Observational Extragalactic Astrophysics	6
5.3 Atmospheric & Ionospheric Physics	8
6. Research Funding	9
7. Collaborations with other institutes	9
8. National & International Committees	10
9. Conference & Workshop Organization	11
10. Visitors	12
11. Publications	12
12. Contact	15

*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).*

---

## 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 2007 calendar year. The staff of the Section consisted of 16 PhD research scientists, 8 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 2007 it resulted in 37 papers published in international refereed journals. 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 2008, 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 16 PhD research scientists, 8 graduate students, and 4 technicians.

The 8 Physics faculty members of the Section during the whole period of the report were Vassilis Charmandaris (Assist. Prof.), Christos Haldoupis (Assoc. Prof.), Despina Hatzidimitriou (Assoc. Prof.), Nikolaos D. Kylafis (Prof.), John Papamastorakis (Prof.), Iossif Papadakis (Assist. Prof.), Ilias M. Vardavas (Assoc. Prof.) and Joseph Ventura (Emeritus 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) continued their affiliation with the Section. Researchers in non-tenure track positions holding a PhD degree were Dr. Angeliki Fotiadi, Dr. Zach Ioannou, Dr. Angelos Misiriotis, Dr. Kostas Pavlakis, Dr. Agnieszka Slowikowska, and Dr. Malgosia Sobolewska. Support staff associated with the Skinakas Observatory were Anastasios Kougentakakis, Dr. Eythymios V. Paleologou, George Paterakis, and Anna Stiakaki.

PhD students during this period were Vallia Antoniou (with D. Hatzidimitriou), Panayotis Lavvas and Marina Papadopoulou (with I. Vardavas), and Agnes Mika (with C. Haldoupis). Masters students in Astrophysics were Theodoros Bitsakis (commenced in fall 2006), Emmanouil Chatzopoulos (commenced in fall 2007), and Antonis Manousakis (commenced in fall 2006). Paolo Bonfini and ERASMUS Masters student from the Univ. of Milano (Bicoca) spent 3 months working on his thesis research project with D. Hatzidimitriou, and Breezy Ocana-Flaquer a PhD student from the Univ. of Granada (Spain) spent 1.5 months working on her thesis with V. Charmandaris.

### 2.2. PERSONNEL CHANGES

Drs. A. Slowikowska and M. Sobolewska joined the group in January and October 2007 respectively, as postdoctoral fellows under a Transfer of Knowledge Marie Curie grant. In Fall 2007, N. Kylafis and J. Papamastorakis were on sabbatical / academic leave. During the calendar year I. Papadakis and V. Charmandaris obtained tenure

as Assistant Professors, D. Hatzidimitriou commenced her appointment as an Associate Professor and P. Reig was promoted to Researcher B'. Dr. Ioannou completed his postdoctoral appointment in the summer of 2007 and is now employed as a researcher at the Informatics & Telematics Institute at the Center for Research and Technology in Thessaloniki. A. Misiriotis passed away on January 4 2008 at the age of 37. He is survived by his wife and two young children.

### 2.3. GRADUATING STUDENTS

A. Mika obtained her PhD degree in May 2007 entitled "Very Low Frequency EM wave studies of Transient Luminous Events in the lower ionosphere<sup>1</sup>" under the supervision of C. Haldoupis. Dr. Mika moved to research scientist position in ARGOSS, a Dutch company that specializes on applied environmental research.

P. Lavvas also obtained his PhD degree entitled "Spatial and temporal variability in the atmosphere and surface of Titan's atmosphere: Simulation and interpretation through space and ground-based observations<sup>2</sup>" in May 2007, under the supervision of I. Vardavas and moved to the Univ. of Arizona as a postdoctoral fellow.

A. Manousakis moved to Geneva Observatory (Switzerland) in September 2007, to continue his graduate studies towards a PhD.

## 3. FACILITIES

### 3.1. SKINAKAS OBSERVATORY

The Skinakas Observatory operates as part of a scientific research collaboration between the University of Crete, the Foundation for Research and Technology-Hellas (FORTH) and the Max-Planck-Institut für Extraterrestrische Physik in Germany. The Observatory 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 30 cm telescope (focal ratio f/3.2) is also available but has not been used during the 2007 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.

The main projects during the 2007 April-to-November observing period were:

- ❑ Photometry and Spectroscopy of Planetary Nebulae and Supernova Remnants.
- ❑ Photometry and Spectroscopy of Binaries with a compact star companion.
- ❑ Photometry of BL Lac objects.
- ❑ R-band and H $\alpha$  monitoring of the central region of M31 for the discovery and

<sup>1</sup> The thesis of Dr. Mika is available at: <http://www.physics.uoc.gr/thesis/Mika.pdf>

<sup>2</sup> The thesis of Dr. Lavvas is available at: <http://www.physics.uoc.gr/thesis/Lavvas.pdf>

follow-up photometry of new Novae.

- ❑ Near-infrared photometry of Hickson Compact Groups.
- ❑ High speed photometry of optical GRB afterglows
- ❑ High photo-polarimetry of X-ray binaries (HMXR, microquasars)
- ❑ Measurements of polarized scattered light from an exoplanetary atmospheres
- ❑ Polarization measurements of the Crab nebula and its pulsar.
- ❑ Spectroscopy of candidate optical counterparts of X-ray sources in M31

In late June 2007 the improved version of the High Time Resolution OPTIMA Instrument ("OPTIMA BURST" <http://www.mpe.mpg.de/OPTIMA/main.html> ) of the Max-Planck Institut für Extraterrestrische Physik was successfully installed at the 1.3 m telescope and it was in operation until the end of September 2007. In November OPTIMA Burst was back on the telescope for two weeks and its polarization was calibrated using the Crab pulsar.

The tradition of "open nights" continued and the Observatory was open to the public for five nights during the 2007 observing season.

More details on the Observatory, the quality of the site, the telescopes, and the available instrumentation can be found at: <http://skinakas.physics.uoc.gr>

### 3.2. IONOSPHERIC PHYSICS LABORATORY

The Ionospheric Physics Laboratory (IPL), maintained operation of its main experimental facility, SESCAT (Sporadic E SCATter experiment), during the summer of 2007. SESCAT, which is the only ionospheric scatter radar that exists in Greece, operates at 50 MHz mostly as a Doppler radar but occasionally also as radio interferometer. It is observing magnetic aspect radio backscatter from electrostatic plasma waves in the E region of the ionosphere during times of strong dense layers of metallic ions, which form at altitudes of  $\sim 100$  km and are subject to plasma instabilities. In addition, IPL in collaboration with Stanford University, continued (since 2003) the un-interrupted operation of a narrow-band very low frequency (VLF) receiver experiment throughout 2007, 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, since summer of 2005, 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 2007, a new GPS (Global Positioning System) receiver station was set up in Crete (in collaboration with the Universite de Rennes, France) for continuous monitoring of the ionospheric variability by measuring total electron content and S4 index changes. E and F region EM coupling studies using joint SESCAT and GPS observations are planned for the near future.

## 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 2007 these were:

- ❑ SPRING SEMESTER 2007
  - "Astrophysics II"
  - "Atmospheric Physics"
  - "Production and Propagation of Radiation in Astrophysics"
  - "Plasma Physics"
  - "Gas Dynamics"
  - "Observational Cosmology"
  - "Reduction and Analysis of Astronomical Observations"
  - "Special Topics in Astrophysics"
  - "Topics of Ionospheric physics"
  
- ❑ FALL SEMESTER 2007
  - "Astrophysics I"
  - "Atmospheric Environment"
  - "Planetary Atmospheres"

## 5. SCIENTIFIC RESEARCH

Here, we present a brief description of the major research projects in which members of the Section were involved in 2007. 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 11.

### 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. (Researchers involved: N. Kylafis, P. Reig)
  
- ❑ Spectral energy distribution of spiral galaxies: A model for spiral galaxies which parameterizes their stellar and dust distribution and self consistently predicts their appearance at all wavelengths can be used to constrain several physical parameters that are not directly observable. Such quantities are the Star Formation Rate, the dust opacity, the intrinsic Spectral Energy Distribution and the star formation history. (Researchers involved: N. Kylafis, A. Misiriotis)
  
- ❑ N-body simulation of Barred Galaxies: N-body simulations of spiral galaxies provide an insight on several dynamical mechanisms, which determine the morphology of barred Galaxies. The mass distribution of the halo, the resonant orbits, and the transfer of angular momentum from the disk to the halo, play a vital role on the long-term evolution of spiral galaxies, and they are examined in detail. (Researchers involved: A. Misiriotis)



## 5.2. OBSERVATIONAL ASTROPHYSICS

### 5.2.1. OBSERVATIONAL GALACTIC ASTROPHYSICS

- ❑ Optical observations of supernova remnants: Deep narrow band observations of supernova remnants are routinely performed with the 0.3m and 1.3m telescopes at Skinakas Observatory. The images are complemented by deep long slit spectra at selected positions of the target objects to study in detail the energy distribution. Supernova remnants contribute to the recycling of heavy elements in the galaxy and impart great amounts of energy to the interstellar medium. The use of interference filters isolating major optical emission lines allow the study of the morphology of these faint objects and the factors that contribute to their shaping. Furthermore, imagery in low and medium ionization lines offers a unique opportunity to study the different zones of emission behind the shock front. The spectra provide useful information about the extinction that the optical emission suffers, the electron density at the given location and the speed of the shock traveling into the interstellar clouds. In addition, estimates of the initial explosion energy can be made if the distance to the remnant is known. (Researchers involved: F. Mavromataakis, J. Papamastorakis, J. Ventura)
- ❑ Optical studies of Cataclysmic Variables: Cataclysmic Variables (CVs) are interacting binary systems where a low mass main sequence star orbits around a white dwarf star (WD). Mass transfer takes place from the main sequence star to the white dwarf through Roche lobe overflow. CVs can be classified into magnetic and non-magnetic systems depending on the magnetic properties of the WD. In systems where the WD magnetic field is low, an accretion disk is present and the WD accretes material through a boundary layer between the surface of the WD star and the accretion disk. If the magnetic field of the WD is of intermediate strength then the inner part of the disk is truncated and accretion takes place via "accretion curtains" that transport material from the inner parts of the accretion disk to the magnetic poles of the WD. Finally, if the magnetic field strength is high enough ( $B > 10^8$  Gauss) it can prevent the formation of an accretion disk and material is trapped by the magnetic field lines and transported directly to the magnetic poles of the WD. The study of the physical processes occurring in these systems is crucial in our understanding of energy and angular momentum transport as well as magnetic viscosity in accretion flows. In 2005 the Skinakas Observatory took part in a worldwide multi-wavelength campaign involving observatories and satellites such as Chandra, GALEX, VLT and the VLA among others investigating the accretion properties of the magnetic CV system AE Aqr. (Researchers involved: Z. Ioannou)
- ❑ 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 investigate their periodic/quasiperiodic/aperiodic variability. To achieve this goal different timing analysis techniques such as power spectra, Fourier-resolved spectra, phase-lag spectra are used. Data mainly come from RXTE and INTEGRAL. (Researchers involved: P. Reig, I. Papadakis)

- ❑ 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. The main objective of this project is to characterize the optical/IR variability time scales of Be/X-ray binaries. This objective is achieved by monitoring the evolution of the disc over many years. The main sources of data are the 1.3 m telescope of the Skinakas Observatory (optical) and the 1.5 m Carlos Sanchez Telescope in Tenerife (IR). (Researchers involved: P. Reig)
- ❑ Search for optical counterparts to HMXB: An optical identification is necessary to facilitate a complete study of these systems. Without a known counterpart, observations are limited to X-ray energies, and hence our understanding of the structure and dynamics of those systems that remain optically unidentified is incomplete. (Researchers involved: P. Reig)
- ❑ Interaction of the neutron star with the Be star's envelope: Be stars may have an isolated life or take part in binaries (the BeX systems). The difference is the presence, or not, of a neutron star. Here the objective 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. One of the main goals is to find observational evidence of such truncation. (Researchers involved: P. Reig, A. Slowikowska)
- ❑ Polarization from an exoplanetary atmospheres: Looking for polarized scattered light from an exoplanetary atmospheres. More than 200 extrasolar planets were discovered by indirect method of Doppler spectroscopy, photometric transits, microlensing, and pulsar timing. So far only atmospheres of transiting planets were detected. Polarization measurements allow to detect directly starlight that is scattered in the planetary atmosphere. The scattered light is linearly polarized perpendicular to the scattering plane. It possesses the information on the planetary atmosphere geometry, chemistry, and thermodynamics. During the OPTIMA-Burst summer campaign at Skinakas Observatory we performed the polarimetric observations of stars that host transiting planets. The aim of the project is to obtain polarization characteristics of the target with very high time resolution as a function of orbital phase of the planet. TrES-3 has one of the shortest orbital periods (31 hours) of the known transiting exoplanets, which makes it an excellent target for orbital-dependent studies. We are looking for changes of the position angle and/or of the polarization degree as a function of orbital period. Additionally, we performed observations of TrES-1 and TrES-2. This is on going project. (Researchers involved: A. Slowikowska, Z. Ioannou)
- ❑ Search for optical periodic and quasi-periodic oscillations in High Mass X-ray Binaries by using high-speed photometer OPTIMA (Researchers Involved: P.Reig, A.Slowikowska).



### 5.2.2. OBSERVATIONAL EXTRAGALACTIC ASTROPHYSICS

- ❑ Study of X-ray sources in M31: In collaboration with W. Pietsch (MPE/Germany) and the XMM-Newton -M31 consortium, we are performing an extensive study of the population of X-ray sources in M31. Two Large Telescope proposals with XMM Newton were awarded time during 2007, in connection to this project. Spectroscopy of optical counterparts has been obtained with the 1.3m Skinakas Telescope, and with the 3.5m telescope at the Apache Point Observatory. (D. Hatzidimitriou, P. Reig, P. Bonfini)
- ❑ Study of X-ray sources in the Small Magellanic Cloud: In collaboration with A. Zezas (CfA/USA), 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, is being conducted using optical imaging and spectroscopy with the 6m-Magellan Telescope, and the 4m-Anglo-Australian Telescope (2df). (Researchers involved: D. Hatzidimitriou, V. Antoniou).
- ❑ Nova monitoring in M31: In collaboration with W. Pietsch, V. Burwitz (MPE/Germany), we use the 1.3m Skinakas Telescope to monitor the central regions of M31, in search of novae. Follow-up spectroscopy of newly discovered novae is also conducted with the Skinakas 1.3m telescope. (D. Hatzidimitriou, P. Reig, P. Bonfini)
- ❑ X-ray variability study of AGN: The study involves the use of data from recent satellites (mainly RXTE and XMM-Newton). One of the main projects is to investigate the observed spectral and flux AGN variations with the new and powerful technique of Fourier resolved spectroscopy. The study of the AGN variability properties and their evolution with cosmic time, using the XMM-Newton archival data on Lockman hole, has been completed (Researchers involved: I. Papadakis, and the MSc student E. Chatzopoulos). A similar study, using archival data from many more recent X-ray surveys is under way. Finally, a systematic study of the spectral variability of a large sample of nearby AGN, on time scales of months/years, has been initiated using archival RXTE Data (Researchers involved: I. Papadakis, and M. Sobolewska).
- ❑ Optical variability study of AGN: We continue to be active members of the "World Earth Blazar Telescope". During 2007 we participated in the worldwide, multifrequency observational campaign on 3C454.3 (Researchers involved: I. Papadakis, J. Papamastorakis). We also initiated a detailed study of the optical variability proper ties of 4 SDSS AGN, with small black hole mass, using data from Skinakas observatory collected in the period between July and September 2007 (Researcher involved: I. Papadakis).
- ❑ Mid-infrared properties of Ultraluminous Infrared Galaxies (ULIRGs): This project uses observations of the Infrared Spectrograph on the Spitzer Space Telescope in order to explore the mid-infrared properties of ULIRGs. The main goal is to improve the understanding of the dominant mechanism of the energy source (accretion onto an active nucleus or a super-massive starburst) in these galaxies by developing a robust diagnostic between a starburst and AGN in dust-enshrouded galactic nuclei. (Researchers involved: V. Charmandaris)

- ❑ Star formation and stellar populations in Hickson Compact Groups: Based on mid-infrared observations of a sample of Hickson Compact Groups obtained with the Infrared Space Observatory and near-infrared imaging data of the Palomar 5 m telescope, this project attempts to map in detail the star formation activity and old stellar population of these systems. (Researchers involved: V. Charmandaris, T. Bitsakis)

### 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 2007 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 electrodynamic coupling between the unstable Es plasma and midlatitude ionospheric "spread F" and the generation of large electric fields in patchy sporadic E plasma layers, 3) the role of plasma density gradients on the generation of short scale electrostatic plasma waves in the ionospheric E region, 4) the effects on VLF (very low frequency) electromagnetic wave propagation and VLF response signatures associated with "transient luminous events", such as sprites and elves, which are atmospheric electricity (thunderstorm and lightning) phenomena in the upper atmosphere

and lower ionosphere, 5) meteor trail plasma instabilities and unusually long-lasting meteor echoes observed with VHF (very high frequency) and HF radars, and 6) studies of ionospheric resonance phenomena observed in ultra low frequency (ULF) electromagnetic noise recordings with sensitive coil magnetometers, and 7) studies of the annual and seasonal variations of midlatitude sporadic E layers. (Researchers involved: C. Haldoupis, and A. Mika)

## 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 Transfer of Knowledge grand for the “Development of an Astrophysics Center in Crete”, (P.I.: N.D. Kylafis, budget: €741,000, duration: 2006-2010)
- ❑ Europlanet: Partners to a network funded by the European Union involving European institutes performing research on planets. Funding was provided for travel to conferences. (P.I. for Greece: I. Vardavas, duration: 2004-2008)
- ❑ Pythagoras II Post-Doctoral Project Award. Research funding for the project of Dr. A. Fotiadi “The Impact of Aerosol Radiative Forcing on the Energy and Water Budget of the Eastern Mediterranean” under the supervision of Prof. Vardavas (budget: €80,000, duration: 2004-2007)
- ❑ PENED Doctoral Project: Research funding for the doctoral thesis of C. Papademas entitled: “Aerosol forcing climatic impacts on the Mediterranean Region”, under the supervision of Prof. Vardavas and Prof. N. Hatzianastassiou (Univ. of Ioannina) ), (budget: €60,000, duration: 2006-2008)
- ❑ Platon: French-Greek scientific exchange on the topic of Titan’s atmosphere. (P.I. I. Vardavas, budget: €12,000, duration: 2006-2008)
- ❑ ESA funded project on the “Support to Development of a Standard Product Generation Pipeline and a Quality Control Framework for Data Products within the Advanced Data Processing System for Herschel”, ESA/Herschel Mission. (P.I.: V. Charmandaris, budget: €271,000, duration: 2006-2009.)
- ❑ European Union (EU) Research Training Network (RTN) project, entitled “Coupling of Atmospheric Layers”, (P.I.: C. Haldoupis, budget: €181,000, duration: 2003-2007).
- ❑ Collaborative research program between GSRT and the Russian Academy of Sciences, entitled “Investigation of the Electrodynamics and Plasma Physics of Ionospheric Phenomena at Midlatitude”. (P.I.: C. Haldoupis, budget: €11,700, duration: 2004-2007).

## 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

- Anglo-Australian Observatory, Australia
- California Institute of Technology, Spitzer Science Center, Pasadena, CA, USA
- CEA/Saclay, Service d'Astrophysique, France
- Cornell University, Astronomy Department, Ithaca, NY, USA
- Danish Space Research Institute (DSRI), Denmark
- East Tennessee State University, TN, USA
- Eötvös-Lenard University, Budapest, Hungary
- ETH, Zurich, Switzerland
- Free University of Berlin, Germany
- Harvard University, Center for Astrophysics, Cambridge, MA, USA
- Imperial College, UK
- Institut d'Astrophysique de Paris, France
- Institute of Physics of the Earth, Russia
- Iowa State University, Dept. of Physics & Astronomy, Ames, IA, USA
- Lawrence Livermore National Lab, CA, USA
- 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
- NASA Marshall Space Flight Center, Huntsville, AL, USA
- National Space Science and Technology Center, Huntsville, AL, USA
- Nicolaus Copernicus Astronomical Center, Torun, Poland
- Observatoire de Marseille, France
- Observatoire de Paris, France
- Royal Observatory Edinburgh, UK
- San Diego State University, CA, USA
- Stanford University, Palo Alto, CA, USA
- Tel Aviv University, Israel
- Université de Rennes, France
- University of Alicante, Spain
- University of Arizona, Tucson, AZ, USA
- University of Bath, UK
- University of Durham, Durham, UK
- University of Oulu, Finland
- University of Saskatchewan, Canada
- University of Southampton, UK
- University of Texas at Austin, TX, USA
- University of 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 is serving as the Secretary of the Hellenic Astronomical Society for the 2006–2008 term. He continued his duties as the Editor of the European Astronomical Society Newsletter (since 2005), Editor of the Newsletter of the Hellenic Astronomical Society (since 1997), as well as the Editor of the Physics Panel of the Annals of the "Marie Curie" Fellowship Association (since 2002). He was

also a member of the 2007 Time Allocation Committee for the Spitzer Space Telescope.

Prof. C. Haldoupis, is serving as an Associate Editor of the Journal of Geophysical Research (JGR), of the American Geophysical Union (2006-2009)

Prof. D. Hatzidimitriou is the President of the IAU Commission 37: "Star Clusters and Associations" for the 2006-2009 term, as well as the Vice-President of the IAU Division VII: "Galactic System" for the 2006-2009 term.

Prof. N. Kylafis was an ordinary member of the Greek National Committee for Astronomy (GNCA) and a substitute to the representative of Greece to the Optical Infrared Coordination Network for Astronomy (OPTICON).

Prof. I. Papadakis was a member of the Governing Council of the Hellenic Astronomical Society for the 2006–2008 term.

Prof. J. Papamastorakis was a substitute member of the Greek National Committee for Astronomy.

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

## 9. CONFERENCE & WORKSHOP ORGANIZATION

Prof. D. Hatzidimitriou was the chair of the organizing committee for the 2007 physics summer school organized for the 19<sup>th</sup> consecutive year by the Physics Department. The summer school provides introductory graduate level courses in various areas of modern physics to senior physics undergraduate students from all Universities of Greece. The theme for this year was "Complex Electronic Materials" (see <http://summer.physics.uoc.gr/> )

Prof. N. Kylafis, I. Papadakis and P. Reig organized a week long Workshop on Microquasars and AGN, in June 2007. The workshop took place in Agios Nikolaos, Crete, and was attended by 27 colleagues from all over the world. Participation was on an invitation basis only, and each presentation was 45 min long. A lot of emphasis was put on encouraging intensive discussions during and after each talk, a strategy which contributed significantly to the success of the workshop.

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 2007 lectures addressed two topics, one in Biology: "Channels and Channelopathies" and one in Physics: "Bose Einstein Condensation" (see <http://www.forth.gr/onassis> ).

## 10. VISITORS

A total of 21 scientists visited our Department in order to collaborate with staff members of the Section and/or give seminars. During the 2007 calendar year these individuals were: Prof. A. Bourdillon (Univ. de Rennes, France), Prof. T. Boesinger (Univ. of Oulu, Finland), Dr. V. Burwitz (MPE, Germany), Dr. G. Chartas (Penn State Univ., USA), Dr. A. Georgakakis (Imperial College, UK), Dr. P. Kalas (Univ. of California, Berkeley, USA), Dr. G. Kanbach (MPE-Garching, Germany), Dr. S. Kazantzidis (Stanford Univ., USA), Dr. F. Nicastro (CfA Harvard Univ., USA), Prof. P. Nicholson (Cornell Univ., USA), Dr. P. Papaderos (Univ. of Gottingen, Germany), Dr. E. Rol (Univ. of Leicester, UK), Dr. P. Sauli (Inst. of Atmospheric Physics, Czech Republic), Prof. G. Stacey (Cornell Univ., USA), Dr. J.-L. Starck (CEA/Saclay, France), Prof. J. Trumper (MPE, Germany), Prof. J. Truran (Univ. of Chicago, USA), Dr. Y. Tsamis (Univ. College London, UK), Dr. A. Vourlidis (Naval Research Lab, USA), Prof. J. Wilms (Univ. of Erlangen-Nuremberg, Germany), Dr. A. Zezas (CfA Harvard Univ., USA).

## 11. PUBLICATIONS

### 11.1. BOOKS

Prof. I. Vardavas published a book entitled "Radiation and Climate", by I.M. Vardavas and F.W. Taylor, International Series of Monographs on Physics No. 138, 512 pp., Oxford University Press, 2007.

### 11.2. REFEREED PAPERS

The following 37 publications of the members of the Section appeared in print in international refereed journals during the 2007 calendar year. This corresponds to ~2.3 refereed publications per PhD researcher. For each publication, the names of the members of the Section are underlined.

1. Armus, L., Charmandaris, V., Bernard-Salas, J., Spoon, H.W.W., Marshall, J.A., Higdon, S.J.U., Desai, V., Teplitz, H.I., Hao, L., Devost, D., Brandl, B.R., Wu, Y., Sloan, G.S., Soifer, B.T., Houck, J.R., Herter, T.L., "Observations of Ultraluminous Infrared Galaxies with the Infrared Spectrograph on the Spitzer Space Telescope II: The IRAS bright Galaxy Sample", 2007, ApJ, 656, 148
2. Boquien, M., Duc, P.-A., Braine, J., Brinks, E., Lisenfeld, U., Charmandaris, V., "Polychromatic View of Intergalactic Star Formation in NGC 5291", 2007, A&A, 497, 93
3. Boumis, P., Meaburn, J., Alikakos, J., Redman, M. P., Akras, S., Mavromatakis, F., López, J. A., Caulet, A., Goudis, C. D., "Deep optical observations of the interaction of the SS 433 microquasar jet with the W50 radio continuum shell", 2007, MNRAS, 381, 308
4. Bournaud, F., Duc, P.-A., Brinks, M.E., Boquien, M., Amram, P., Lisenfeld, U., Koribalski, B., Walter, F., Charmandaris, V., "Missing mass in collisional debris from galaxies ", 2007, Science, 316, 1166
5. Brinkmann, W., Papadakis, I. E., Raeth, C., "Spectral variability analysis of an XMM-Newton observation of Ark 564", 2007, A&A, 465, 107
6. Desai, V., Armus, L., Spoon, H.W.W., Charmandaris, V., Marshall, J.A., Teplitz, H.I., Bernard-Salas, J., Soifer, B.T., Houck, J.R., Farrah, D., Brandl, B.R.,



- Devost, D., Higdon, S.J.U., "PAH Emission from Ultraluminous Infrared Galaxies", 2007, ApJ, 669, 810
7. Farrah, D., Bernard-Salas, J., Spoon, H. W. W., Soifer, B. T.; Armus, L., Brandl, B.R., Charmandaris, V., Desai, V., Higdon, S., Devost, D., Houck, J.R., "High resolution mid-infrared spectroscopy of ultraluminous infrared galaxies", 2007, ApJ, 667, 107
  8. Gallo, L. C.; Brandt, W. N.; Costantini, E.; Fabian, A. C.; Iwasawa, K.; Papadakis, I. E., "A longer XMM-Newton look at I Zwicky 1: variability of the X-ray continuum, absorption and iron K $\alpha$  line", 2007, MNRAS, 377, 391
  9. Gliozzi, M., Papadakis, I. E., Brinkmann, W. P., "Long-Term X-Ray Spectral Variability of the Radio-Loud Narrow-Line Seyfert 1 Galaxy PKS 0558-504", 2007, ApJ, 656, 691
  10. Haldoupis, C., Pancheva, D., Singer, W., Meek, C., MacDougall, J., "An explanation for the seasonal dependence of midlatitude sporadic E layers", 2007, Journal of Geophysical Research, Volume 112, Issue A6, CiteID A06315
  11. Hancock, M., Smith, B.J., Struck, C., Giroux, M., Appleton, P.N., Charmandaris, V., Reach, W.T., "Large-scale Star Formation Triggering in the Low-mass Arp 82 System: A Nearby Example of Galaxy Downsizing Based on UV/Optical/Mid-IR Imaging", 2007, AJ 133, 676
  12. Hatzianastassiou, N., Matsoukas, C., Fotiadi, A., Stackhouse, P. W., Jr., Koepke, P., Pavlakis, K. G., Vardavas, I., "Modelling the direct effect of aerosols in the solar near-infrared on a planetary scale", 2007, Atmospheric Chemistry and Physics, Vol. 7, Issue 12, pp.3211-3229
  13. Hatzianastassiou, N., Matsoukas, C., Drakakis, E., Stackhouse, P. W., Jr., Koepke, P., Fotiadi, A., Pavlakis, K. G., Vardavas, I., "The direct effect of aerosols on solar radiation based on satellite observations, reanalysis datasets, and spectral aerosol optical properties from Global Aerosol Data Set (GADS)", 2007, Atmospheric Chemistry and Physics, Volume 7, Issue 10, pp.2585-2599
  14. Hatzidimitriou, D., Reig, P., Manousakis, A., Pietsch, W., Burwitz, V., Papamastorakis, I., "M31N 2005-09c: a fast Fe II nova in the disk of M 31", 2007, A&A, 464, 1075
  15. Howarth, Ian D., Walborn, Nolan R., Lennon, Danny J., Puls, Joachim, Nazé, Yaël, Annuk, K., Antokhin, I., Bohlender, D., Bond, H., Donati, J.-F., Georgiev, L., Gies, D., Harmer, D., Herrero, A., Kolka, I., McDavid, D., Morel, T., Negueruela, I., Rauw, G., Reig, P., "Towards an understanding of the Of?p star HD 191612: optical spectroscopy", 2007, MNRAS, 381, 433
  16. Kalivitis, N., Gerasopoulos, E., Vrekoussis, M., Kouvarakis, G., Kubilay, N., Hatzianastassiou, N., Vardavas, I., Mihalopoulos, N., "Dust transport over the eastern Mediterranean derived from Total Ozone Mapping Spectrometer, Aerosol Robotic Network, and surface measurements", 2007, Journal of Geophysical Research, Volume 112, Issue D3, CiteID D03202
  17. Lahuis, F., Spoon, H.W.W., Tielens, A.G.G.M., Doty, S.D., Armus, L., Charmandaris, V., Houck, J.R., Stuber, P., van Dishoeck, E.F., "Infrared Molecular Starburst Fingerprints in Deeply Obscured ULIRG Nuclei", 2007, ApJ, 659, 296
  18. Markowitz, A., Papadakis, I., Arévalo, P., Turner, T. J., Miller, L.; Reeves, J. N., "The Energy-dependent X-Ray Timing Characteristics of the Narrow-Line Seyfert 1 Mrk 766", 2007, ApJ, 656, 116
  19. Marshall, J.A., Herter, T.L., Armus, L., Charmandaris, V., Spoon, H.W.W., Bernard-Salas, J., Houck, J.R., "Decomposing Dusty Galaxies I: Multicomponent Spectral Energy Distribution Fitting", 2007, ApJ, 670, 129

20. Matsoukas, C., Banks, A. C., Pav lakis, K. G., Hatzianastassiou, N., Stackhouse, P. W., Jr., Vardavas, I., "Seasonal heat budgets of the Red and Black seas", 2007, J. Geophys. Res., 112, C10017
21. Mavromatakis, F., Gueymard, C. A., Franghiadakis, Y., "Improved total atmospheric water vapour amount determination from near-infrared filter measurements with sun photometers", 2007 Atmospheric Chemistry and Physics Discussions, Volume 7, Issue 3, 2007, pp.6113-6141
22. Mavromatakis, F., Xilouris, E. M., Boumis, P., "The optical properties of the G89.0+4.7 (HB 21) supernova remnant", 2007, A&A, 461, 991
23. McHardy, I. M., Arévalo, P., Uttley, P., Papadakis, I. E., Summons, D. P., Brinkmann, W., Page, M. J., "Discovery of multiple Lorentzian components in the X-ray timing properties of the Narrow Line Seyfert 1 Ark 564", 2007, MNRAS, 382, 985
24. Mignani, R. P., Bagnulo, S., Dyks, J., Lo Curto, G., Słowikowska, A., "The optical polarisation of the Vela pulsar revisited", 2007, A&A, 467, 1157
25. Papadakis, I. E., Brinkmann, W., Page, M. J., Mc Hardy, I., Uttley, P., "XMM-Newton observation of the NLS1 galaxy Ark 564. I. Spectral analysis of the time-average spectrum", 2007, A&A, 461, 931
26. Papadakis, I. E., Ioannou, Z., Kazanas, D., "Fourier-Resolved Spectroscopy of Active Galactic Nuclei Using XMM-Newton Data. I. The 3-10 keV Band Results", 2007, ApJ, 661, 38
27. Papadakis, I. E., Villata, M., Raiteri, C. M., "The long-term optical spectral variability of BL Lacertae", 2007, A&A, 470, 857
28. Pav lakis, K. G., Hatzidimitriou, D., Drakakis, E., Matsoukas, C., Fotiadi, A., Hatzianastassiou, N., Vardavas, I., "ENSO surface longwave radiation forcing over the tropical Pacific", Atmospheric Chemistry and Physics, Volume 7, Issue 8, 2007, pp.2013-2026
29. Raiteri, C. M., Villata, M., Larionov, V. M., Pursimo, T., Ibrahimov, M. A., Nilsson, K., Aller, M. F., Kurtanidze, O. M., Foschini, L., Ohlert, J., Papadakis, I. E., Sumitomo, N., Volvach, A., Aller, H. D., Arkharov, A. A., Bach, U., Berdyugin, A., Böttcher, M., Buemi, C. S., Calcidesse, P., Charlot, P., Delgado Sánchez, A. J., di Paola, A., Djupvik, A. A., Dolci, M., Efimova, N. V., Fan, J. H., Forné, E., Gomez, C. A., Gupta, A. C., Hagen-Thorn, V. A., Hooks, L., Hovatta, T., Ishii, Y., Kamada, M., Konstantinova, T., Kopatskaya, E., Kovalev, Yu. A., Kovalev, Y. Y., Lähteenmäki, A., Lanteri, L., Le Campion, J.-F., Lee, C.-U., Leto, P., Lin, H.-C., Lindfors, E., Mingaliev, M. G., Mizoguchi, S., Nicastro, F., Nikolashvili, M. G., Nishiyama, S., Östman, L., Ovcharov, E., Pääkkönen, P., Pasanen, M., Pian, E., Rector, T., Ros, J. A., Sadakane, K., Selj, J. H., Semkov, E., Sharapov, D., Somero, A., Stanev, I., Strigachev, A., Takalo, L., Tanaka, K., Tavani, M., Tornainen, I., Tornikoski, M., Trigilio, C., Umana, G., Vercellone, S., Valcheva, A., Volvach, L., Yamanaka, M., "WEBC and XMM-Newton observations of 3C 454.3 during the post-outburst phase. Detection of the little and big blue bumps", 2007, A&A, 473, 819
30. Reig, P., Larionov, V., Negueruela, I., Arkharov, A. A., Kudryavtseva, N. A., "The Be/X-ray transient 4U 0115+63/V635 Cassiopeiae. III. Quasi-cyclic variability", 2007, A&A, 462, 1081
31. Reig, P., "On the neutron star-disc interaction in Be/X-ray binaries", 2007, MNRAS, 377, 867
32. Shrader, C. R., Reig, P., Kazanas, D., "Fourier-Resolved Spectroscopy of 4U 1728-34: New Insights into Spectral and Temporal Properties of Low-Mass X-Ray Binaries", 2007, ApJ, 667, 1063

33. Smith, B.J., Struck, C., Hancock, M., Appleton, P.N., Charmandaris, V., Reach, W.T., "The Spitzer Spirals, Bridges, and Tails Interacting Galaxy Survey: Interaction-Induced Star Formation in the Mid-Infrared", 2007, AJ, 133, 791
34. Spoon, H.W.W., Marshall, J.A., Houck, J.R., Elitzur, K., Hao, L., Armus, L., Brandl, B.R., Charmandaris, V., "Mid-IR Galaxy Classification Based on Silicate obscuration and PAH Equivalent Width", 2007, ApJ Letters, 654, 49
35. Teplitz, H.I., Desai, V., Armus, L., Chary, R., Mashall, J.A. Colbert, J.W., Frayer, D.T., Pope, A., Blain, A., Spoon, H.W.W., Charmandaris, V., Scott, D., "Measuring PAH Emission in Ultradeep Spitzer IRS Spectroscopy of High Redshift IR Luminous Galaxies", 2007, ApJ, 659, 941
36. Whelan, D.G., Devost, D., Charmandaris, V., Marshall, J.A., Houck, J.R., "Spitzer/IRS Spectroscopy of the luminous infrared galaxy NGC6052", 2007, ApJ, 666, 896
37. Wu, Y., Charmandaris, V., Hunt, L., Bernard-Salas, J., Brandl, B.R., Marshall, J.A., Leboutteiller, V., Hao, L., Houck, J.R., "Dust in the Extremely Metal-Poor Blue Compact Dwarf Galaxy IZw18: the Spitzer Mid-infrared View", 2007, ApJ , 662, 952

## 12. 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 2007 it consisted of 34 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:

University of Crete  
Department of Physics  
Section of Astrophysics and Space Physics  
GR-71003 Heraklion  
Greece

phone: +30 2810 394300  
fax: +30 2810 394301

More details on how to reach an individual member by phone or e-mail are available in the web page of the Department of Physics at: <http://www.physics.uoc.gr>

