Institute of Astrophysics

FOUNDATION FOR RESEARCH & TECHNOLOGY – HELLAS (FORTH)

VISION AND GOALS

In order to succeed, we must first believe that we can.

N. KAZANTZAKIS

Even though small in size, the vision and goals of the Institute of Astrophysics are ambitious. We aim to:

- perform cutting-edge, internationally recognized, research in select areas of Theoretical and Observational Astrophysics,
- provide excellent training to students and early-stage researchers in order for them to acquire the technical and analytical skills necessary to address outstanding questions in Astrophysics and succeed in a competitive job market,
- collaborate with public and private stakeholders to engage the local community in public outreach activities, showcasing seminal astronomical findings,
- educate the general public on the positive impact of basic science on society.

Institute of Astrophysics

The Institute of Astrophysics (IA) commenced its operations at FORTH in 2019 and it is the only Research Institute in Greece dedicated exclusively to the field of Astrophysics.

The Institute was founded in order to facilitate and further enhance the very successful research activities of the Astrophysics Group, which had been operating for nearly 30 years, within the Institute of Electronic Structure and Laser (IESL) of FORTH and the Department of Physics of the University of Crete.

The first priority of the Institute is to foster and promote excellence in research and innovation in select fields of Theoretical and Observational Astrophysics. Moreover, using the facilities of Skinakas Observatory, it will continue to train the new generation of scientists and engineers in order to successfully address the upcoming challenges in modern Astrophysics and Technology.

Relying on the cross-discipline scientific expertise and unique environment of FORTH, the ambition of IA is to develop strategic international collaborations and act as a catalyst and pole of attraction for outstanding scholars from abroad. This will enable Greece to contribute to, as well as profit from, this rapidly developing research field in a substantive manner.

The sky is not our limit!

Research Excellence

Without data you are just another person with an opinion.

W. EDWARDS DEMING

From 2005 to the end of 2019, the members of the Astrophysics Group of IESL-FORTH and currently members of IA have published ~ 600 papers in peer-reviewed journals, and trained 12 PhD and 27 MSc students, as well as 17 postdoctoral fellows.

The total funding the members of IA have secured through competitive research programs, during the period from 2005 through 2019, is € 9.4 million.

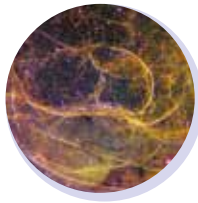
Among the 7 permanent members of IA, existing at the beginning of 2020, there are 2 whose quality of research has been recognized and funded by the highly competitive European Research Council (ERC) grants, while another researcher received the 2014 "L'Oreal-UNESCO Award for Women in Science".

In early 2020, the cumulative research work of the 7 permanent members of IA (mean age of 47 years) during their careers amounts to ~ 750 papers published in peer-reviewed research journals, which have received ~ 33,000 citations.

Research Areas

Extrasolar Planets

Over the past 25 years, several thousand planetary systems around stars have been discovered and characterized, leading to the creation of a new field in Astrophysics encompassing many sub-disciplines: from planet formation and circumstellar disks, to astrobiology and search for signatures of technological civilizations. Our focus is mainly on observational studies of dusty debris disks and wide-separation gas giant planets using the largest telescopes from the ground and space.



Star Formation

Stars are the building blocks of galaxies. The process of star formation from rarified gas is complex and lies at the foundation of modern Astrophysics. Members of IA study the physics of molecular clouds, the stellar nurseries, focusing on the role of magnetic fields, combining observations in the infrared and the optical with state-of-the-art numerical simulations.

X-ray-Binaries

X-ray binaries are systems consisting of a star and a stellar remnant, that is a black hole, a neutron star, or a white dwarf. When material from the star falls onto the remnant, it is heated to temperatures of several million degrees, produces copious X-ray emission and often causes the creation of jet-like collimated outflows or wide-angle winds of highly ionized plasma. IA researchers have embarked in long-term observational and theoretical studies of these extreme laboratories, examining the effects of strong gravity, the properties of the stellar remnant, as well as revealing unknown details in the late stages of stellar evolution.

The images of the flyer are from the album "Skinakas Observatory: a view to the Universe" M. Palaiologou & I. Papamastorakis, Crete University Press, 2010

Supernova Remnants

Massive stars end their lives with spectacular explosions as supernovae. These explosions enrich the interstellar material with the heavy elements that have been produced in the interior of stars and inject copious amounts of energy via shocks. Members of IA lead optical and X-ray studies to understand in detail the properties of individual supernova remnants, as well as how their population evolves.

Galaxy Evolution

Galaxies, originally considered as “island universes”, consist of billions of stars, as well as gas, dust and yet unknown “dark matter”. From the creation of the Universe until today, they evolve changing their morphology, either passively or via gravitational interactions with each other. In the process, they convert their gas into stars, often feeding their central supermassive black holes. Using observations across the whole electromagnetic spectrum, members of IA trace this evolution quantifying the dominant physical mechanisms responsible for their transformation.

Active Galactic Nuclei

Accretion of matter onto supermassive black holes, located in the centers of nearly all galaxies, produces some of the most spectacular phenomena in Extragalactic Astrophysics: from giant radio-galaxies to blazars. Researchers of IA probe the physical mechanisms of energy production in these Active Galactic Nuclei, using mainly variability studies and polarization measurements from ground facilities, as well as X-ray and infrared spectroscopy from space telescopes.

Large-scale Structure and Cosmology

Analytical calculations and numerical simulations performed at IA reveal the properties of the largest structures in the Universe, galaxy clusters and superclusters, and trace the physics of the hidden elements which shape their evolution: dark matter and dark energy.

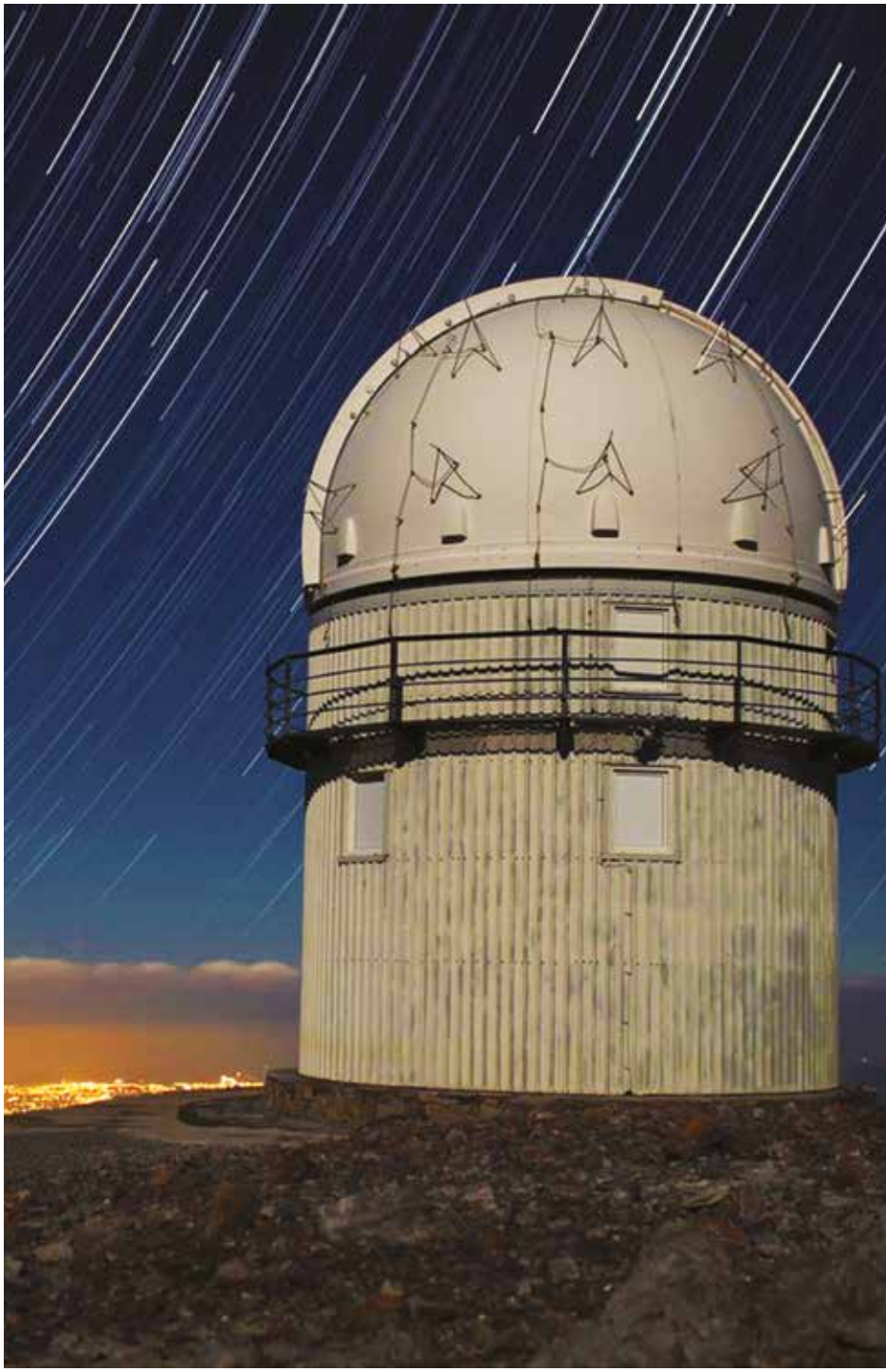
Ultra-high-energy Cosmic Rays

Ultra-high-energy cosmic rays are the highest-energy charged particles in the Universe. Researchers of IA study these extreme particles, simulate their interactions in the atmosphere of the Earth, and map the magnetic field of our Galaxy to conclusively identify their, yet to be discovered, origin.

Polarimetry

IA hosts a world-class center for polarimetric studies of point and extended sources in the optical, featuring cutting-edge innovative instruments, as well as international collaborations with world-leading groups in polarimetric instrumentation and theoretical studies of relevant astrophysical phenomena. Current optopolarimetric programs taking place at Skinakas Observatory include PASIPHAE, RoboPol, and CIRCE/ PHAESTOS.

Skinakas Observatory



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SKINAKAS
OBSERVATORY

Skinakas Observatory

Skinakas Observatory is located on top of Ida mountain in Central Crete at an altitude of 1750m and it is a joint research facility of the University of Crete and the Foundation for Research and Technology - Hellas (FORTH).

The observatory was founded in 1984, with the installation of a wide-field Schmidt-Cassegrain telescope, having a mirror 0.3m in diameter. In 1995, a larger 1.3m Ritchey-Chrétien telescope became operational on the site and it was followed, in 2006 by a third fully robotic 0.6m Cassegrain telescope.

The excellent weather conditions for astronomical observations at the Skinakas mountaintop, coupled with the modern instrumentation available at the Observatory and the initiatives of the local astronomers, have enabled Skinakas Observatory to be the most productive in Greece in terms of scientific publications.

It is worth noting that the first digital camera (CCD) for astronomical observations in Greece was installed in Skinakas in 1986, as was the first near-infrared camera in 2006. More recently, the RoboPol and WALOP optical polarimeters offer unique state-of-the-art scientific capabilities.

Skinakas Observatory also offers free open day events to its facilities, making them accessible to the general public and organized groups every year. This provides the opportunity for visitors of all ages to become familiar with the operation of the Observatory, as well as to observe the magnificent starry sky through a telescope eyepiece.

http://skinakas.physics.uoc.gr/en/

PERSONNEL

It is the people who defend a city, not its walls.
THUCYDIDES

Following the long tradition of the Foundation for Research and Technology - Hellas (FORTH) and the University of Crete, the Institute of Astrophysics pays special attention to the recruitment of its research personnel.

All permanent researchers and affiliated university faculty of the Institute of Astrophysics, originally as members of the Astrophysics Group of the Institute of Electronic Structure and Laser (IESL) at FORTH, have obtained their PhD and have extensive research experience in the best research Institutes and Universities in Europe and the USA.

This allows them to maintain close research links, as well as develop new collaborations with the most active astrophysics research teams in the world, thus offering to the students and the postdoctoral researchers trained in Crete unique opportunities for pursuing a successful research career.

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