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- **What is IScAI?**

The International School for Advanced Instrumentation (IScAI) is a major international initiative in higher education that aims to become a centre of excellence to learn expertise in all areas related to the construction of cutting-edge scientific instrumentation, with a particular emphasis on astronomical instrumentation.

The thrust of IScAI is to educate the necessary workforce of specialized personnel in scientific instrumentation and facilitate the partnerships of universities, research institutes and high-tech companies in the construction of state-of-the-art instrumentation for the new generation of scientific facilities. IScAI will also serve as a bridge between the intellectual resources and technology transfer capabilities of universities, research institutes and high-tech companies.

After the successful pilot program in 2008, the IScAI officially starts in 2009. IScAI-2009 offers an intensive programme of courses and laboratory work in key areas related to the design and construction of scientific instrumentation. The laboratory work will be done at various research institutions and high-tech companies with world-class instrumentation programs in Europe and America.

IScAI-2009 is open to astronomers, physicists and engineers world-wide.

To download the brochure of the IScAI-2009 click on the following [link](#)

IScAI-2009 is funded by the [Consolider-Ingenio 2010](#) grant “First Science with the GTC” under the Consolider Ingenio 2010 Programme of the Spanish Ministry of Science and Innovation. IScAI is a multicenter collaborative effort among high-tech companies and research institutions.



- STUDENTS

The IScAI is open to astronomers, physicists and engineers world-wide.

The IScAI will offer the students:

- A highly specialized curriculum of courses in frontline scientific instrumentation that will provide

the necessary expertise to become Principal Investigators responsible for the construction of the future generation of instruments for ground-based and space observatories.

- Internships working with world-class instrumentation groups in academic institutions and high-tech companies.

- Tutors to supervise their progress in all activities of the School. Students will be required to deliver a written report of activities and present the results of their work in an oral contribution to the IScAI Board of Directors at the end of the Pilot Programme.

- Participating institutions will provide the laboratory equipment required for completing successfully the internship.



- **Programme**

The programme consists of:

- three months of intensive course work on different subjects (optics, mechanics, electronics, software and management) related to the design and construction of astronomical instrumentation, to be held at the headquarters of the [Instituto de Astrofísica de Canarias \(IAC\)](#) in La Laguna, Tenerife (Canary Islands, Spain).

- three and a half months of laboratory work during internships held at the scientific institution or high-tech company assigned to each student. The assignment of the internships will be made

by the IScAI Board of Directors considering the preferences expressed by prospective students in the application form.



- **Courses**

From 2009 June 8th to August 28th IScAI students will take five intensive courses, to be held at the [IAC](#) headquarters in Tenerife (Canary Islands, Spain):

Optics- (30 hours): Students will learn the basic concepts of optics and imaging, and the use of optical design/analysis software tools. The course will provide an overview of common astronomical optical systems, including telescopes, cameras, and spectrographs, and their common components (mirror, lenses, etc.). It will present a basic methodology for preliminary layout and analysis of astronomical instrument systems. Lecturer: Stephen S. Eikenberry. Dates: 2009 June 8th to July 3rd.

Mechanics- (30 hours): Students will learn the basis of mechanical design, including analysis of precision designs for opto-mechanical and robotic systems, and other related disciplines, including materials, mechanical components, cryogenics systems, vacuum technology, structures and mechanical manufacturing processes. Lecturer: Vicente Sánchez. Dates: 2009 June 8th to July 3rd.

Electronics- (30 hours): Students will learn the basis of electronic design, including instrument control software, astrophysics instrumentation requirements and detectors. Lecturer: José Javier Díaz. Dates: 2009 July 6th to August 7th.

Software- (30 hours): Students will be familiarised not only with the latest trends in software design, but also with modern tools to guarantee the appropriate quality in software

development. Lecturer: Sergio Pascual. Dates: 2009 July 6th to August 7th.

Management- (20 hours): Students will learn to describe projects in terms of work packages, to establish a schedule with milestones and deadlines, to control budget and cash flow and to discuss requirements and specifications with both the scientists and the engineers to make them to understand the project. Lecturer: Marisa García Vargas. Dates: 2009 August 10th to August 28

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- Internships

From 2009 September 7th to December 11th students will work at the laboratories of a partner company or scientific institution in Europe or America, carrying out a instrumentation project in collaboration with their experienced instrumentation teams. The high-tech company or scientific institution hosting an IScAI student will provide all required laboratory equipment and assign a tutor who will supervise the progress of the student during his/her internship.

Internships will be assigned to each student by the IScAI Board of Directors, considering the preferences expressed by prospective students in the application form.

The areas for instrumentation projects offered for IScAI 2009 include:

- [Instituto de Astrofísica de Canarias \(IAC\)](#) – La Laguna, Tenerife, Canary Islands, Spain:

1. Control and characterization of visible and infrared detectors

- [University of Florida \(UF\)](#) – Gainesville, Florida, USA:

1. Integration and Testing of the Canarias Infrared Camera Experiment (CIRCE)

- [Universidad Complutense de Madrid \(UCM\)](#) – Ciudad Universitaria, Madrid, Spain:

1. Design and development of a software tool for the evolution of galaxy luminosity functions

- [Universidad Nacional Autónoma de México \(UNAM\)](#) – México D.F. / Ensenada, Mexico:

1. ALBatros (Alignment Bench) Upgrading

2. A Data Pipeline for RATIR (new camera on the 1.5 meter telescope of the Mexican National Astronomical Observatory in Sierra San Pedro Martir)

3. Gravitational & Alignment Effects on Optical Performance of the Wide-Field SASIR Telescope

- [Instituto Nacional de Astrofísica, Óptica y Electrónica \(INAOE\)](#) – Tonantzintla, Puebla, Mexico:

1. Beamformer Arrays for Millimeter Wave Astronomy

2. Fourier Transform Spectrometer to characterize the atmosphere at millimeter wavelengths at the LMT site

3. Optical alignment of a telescope using a Ronchi ruling

- [Centro de AstroBiología \(CAB\)](#) – Torrejón de Ardoz, Madrid, Spain:

1. Instrument MIXS for the Bepi Colombo mission (Mercury)

2. Instrument REMS for the MSL mission (Mars)

3. Instrument Raman-LIBS for the ExoMars mission (Mars)

4. Simulation chambers for planetary environments

5. SOLID Experiment: detection of bio-markers in planetary environments

- [Instituto Nacional de Técnica Aeroespacial \(INTA\)](#) – Torrejón de Ardoz, Madrid, Spain:

- [GMV](#) – Tres Cantos, Madrid, Spain:

1. Development of Product Validation and Analysis tools for the ESA's SMOS space mission

- [LIDAX](#) – Torrejón de Ardoz, Madrid, Spain:

1. Design and construction of an Atmosphere Simulator and Telescope for Adaptive Optics studies

2. Design and construction of the focal plane of the MIXS instrument for the BepiColombo mission

3. Preliminary design of a focal plane with multiple CCD for the PLATO mission

4. Methodology studies about sub-micrometric measurements in cryogenic environments for infrared instrumentation

5. Development of a sub-micrometric actuator for a cryogenic environment

- [NTE S.A.](#) – Lliçà d'Amunt, Barcelona, Spain:

1.E-ELT M5 Field Stabilization Unit Demonstrator fine tuning and performance verification

- [FRACTAL SLNE](#) – Las Rozas de Madrid, Madrid, Spain:

1. Area of work: Spectrograph Design under supervision of Fractal's engineers

- [EADS Astrium Crisa](#) – Tres Cantos, Madrid, Spain:

1. Development of electronic equipment for instruments on earth observation or scientific satellite payloads

- [IDOM](#) :

1. QUIJOTE CMB Experiment Instrumentation

2. FASTCAM Instrument



- **Evaluation**

Student's performance will be evaluated both during the course work and during the internship.

A student must successfully complete the course work before starting the internship. Evaluation of the course work will be done by each professor through individual homework exercises, laboratory practices and, at the end of each course, a class project.

Evaluation of the lab work during the internship will be done by the IScAI Board of Directors through a written report summarizing the student's work and an oral presentation. Students will have to submit this report to the IScAI Administrative Manager before 2009 December 12th.

Final evaluation of the overall performance of the student in all activities of the IScAI will be done by the IScAI Board of Directors.



- **Participation**

Those students interested in attending the IScAI have two options:

1. Registered students:

They will attend the classes at the Instituto de Astrofísica de Canarias (IAC) during the course work period of the IScAI (from 2009 June 8th to August 28th), and will work at any of the IScAI partner companies or institutions during their internship. Interested students must fill in the application form and upload the required documents before 2009 February 15th

2. On-line registered students:

They will attend to the classes on-line by means of the e-learning tools offered by the Distance Learning Pilot Program of IScAI 2009. During the internship period they will work in nearby high-tech companies or research institutes collaborating with the IScAI. Interested students must fill in the application form and upload the required documents before 2009 February 15th. Only 2 or 3 applicants will be selected for this 2009 IScAI Distance Learning Pilot Programme.

By 2009 February 22th we will contact the applicants in order to:

1. Notify all students the decision by the Board of Directors regarding their applications.
2. Inform accepted students about the financial aid that they have been awarded and the project that they have been assigned.
3. Request a letter from accepted students confirming their participation in the IScAI.



- **Schedule**

Jun 8

Welcome and introduction to the IScAI

Jun 8 - Jun26

Optics (30 hours) & Mechanics (30 hours)

Jun 29 - Jul 3

Optics & Mechanics projects

Jul 6 - Jul 24

Software (30 hours) & Electronics (30 hours)

Jul 27 - Jul 31

Software & Electronics projects

Aug 3 - Aug 14

Management (20 hours)

Aug 17 - Aug 21

Management project

Aug 28

Deadline for submission of class projects

Aug 31 - Sep 4

Travel to Institutions/Companies

Sep 7 - Dec 11

Laboratory work

Dec 11

Deadline for submission of Lab Report

Dec 16 - Dec 17

Oral presentations by the students.
Evaluations by the Board of Directors

Dec 18

Graduation

In addition to the course work, during the period Aug 10-21 various complementary activities will take place, including monographic conferences by invited speakers and a visit to the Gran Telescopio Canarias (GTC).



- COMPANIES

Companies and IScAI:

The IScAI is open to high-tech companies with expertise in cutting-edge scientific instrumentation in Europe and America interested to participate in 2009.

Recent years have seen a dramatic increase in the development of instruments for the new generation of large ground-based observatories. In the early 1990's, the budgets for "large instruments" were typically in the range of 1M€ and small teams at the universities carried out their construction. By now, the current generation of instruments under construction or being planned for major observatories have budgets ranging from 20M€ to 70M€ – an increase of nearly 2 orders of magnitude in just over a decade.

The instruments for the future generation of extremely large ground-based telescopes and space observatories will be even more complex and expensive. Likewise, the size and composition of the teams required to construct such instruments has changed dramatically, involving dozens of scientists and engineers from academic institutions and high-tech companies around the world.

Participating companies in the IScAI will benefit from:

1. The opportunity to train a highly specialized work-force in tune with their needs and areas of expertise
2. A preferred access to partnerships with scientific institutions for building the next generation of scientific instrumentation.

As a partner, a company is expected, first, to propose an internship project, and second, to host IScAI students during their internship to work in its laboratories in collaborative projects with your experienced instrumentation teams.

Participating companies and companies will need to provide some information:

1. A self-contained, well-defined and well-planned instrumentation project that can be completed during the three months and a half internship.

2. A proposal for a set of deliverables to be submitted by the students at the end of their internship, in order to evaluate their performance.

The participating institutions must also guarantee:

- a. A tutor who will supervise the progress of the students during their internship.

- b. All laboratory equipment required for completing successfully the internship.

In the event that no other sources of funding are available, IScAI will provide the necessary financial aid for the students during their internships at these companies.

If you would like to learn more about how your company can become a partner in the IScAI 2009 or you have any questions, please do not hesitate to contact Mercedes Franqueira, the IScAI manager (at mmf@iac.es, address: Instituto de Astrofísica de Canarias, C/ Vía Láctea s/n, E-38205 La Laguna, Spain), or the executive director of the IScAI-2009, Rafael Guzmán, (at guzman@astro.ufl.edu, address: 216 Bryant Space Science Center; P.O. Box 112055, University of Florida, Gainesville, FL 32611-2055).

Partner companies in the IScAI-2009

FRACTAL is a brand-new company with a very high expertise in instrumentation. Fractal people have been several years working in the GTC project, covering all the instrumentation aspects. ELMER instrument for GTC is a great success where Fractal people had a very strong contribution. Fractal is focused now in very specialized courses about all aspects of instrumentation.

GMV is a privately owned technological business group with an international presence. Founded in 1984, GMV offers its solutions, services and products in very diverse sectors: Aeronautics, Banking and Finances, Space, Defense, Health, Security, Transportation, Telecommunications, and Information Technology for Public Administration and large corporations. GMV was the only company collaborating in the IScAI Pilot Program in 2008.

LIDAX is a spanish SME that offers a response to the needs its clients may find when developing Advanced Mechanical Equipment. This equipment can be either a part of Functional On-board Subsystems for aircrafts or satellites or a part of cutting-edge scientific instrumentation.

NTE S.A. provides engineering services for the development of custom, high-performance systems, instruments and equipment for advanced research and applications. The original focus on solutions for the Life Sciences and Biomedical sectors has evolved to cover needs in other scientific domains as well. Nowadays, NTE's activities address the needs of research centers, technological institutes, healthcare organizations and industrial companies which require high added-value engineering partnerships and solutions.

EADS Astrium CRISA (Computadoras, Redes e Ingeniería , S.A.) is a Spanish company founded in 1985 to design and manufacture electronic equipment and software for space applications: satellites, launchers, orbital infrastructure and space transportation vehicles. Other activities include engineering projects for ground stations, defence and audiovisual sectors.

IDOM is one of the leading companies in the Spanish market for professional services in Engineering, Architecture and Consulting and, at present, is taking the necessary steps to

extend that leading position into the international arena.



- INSTITUTIONS

Research Institutions and IScAI

The IScAI is open to scientific institutions with expertise in cutting-edge scientific instrumentation in Europe and America interested to participate in 2009. As a partner, an institution is expected, first, to propose an internship project, and second, to host IScAI students during their internship to work in its laboratories in collaborative projects with your experienced instrumentation teams.

Participating research institutions will need to provide some information:

1. A self-contained, well-defined and well-planned instrumentation project that can be completed during the three months and a half internship.

2. A proposal for a set of deliverables to be submitted by the students at the end of their internship, in order to evaluate their performance.

The participating institutions must also guarantee:

- a. A tutor who will supervise the progress of the students during their internship.

- b. All laboratory equipment required for completing successfully the internship.

In the event that no other sources of funding are available, IScAI will provide the necessary financial aid for students during their internships.

If you would like to learn more about how your institution can become a partner in the IScAI 2009 or you have any questions, please do not hesitate to contact Mercedes Franqueira, the IScAI manager (at mmf@iac.es, address: *Instituto de Astrofísica de Canarias, C/ Vía Láctea s/n, E-38205 La Laguna, Spain*), or the executive director of the IScAI2009, Rafael Guzmán, (at guzman@astro.ufl.edu

, address: *216 Bryant Space Science Center; P.O. Box 112055, University of Florida, Gainesville, FL 32611-2055*).

Founder Research Institutions

- Instituto de Astrofísica de Canarias (IAC, Spain) IAC / Universidad de La Laguna is the institution that has built more ground-based and space astronomical instrumentation in Spain. Several GTC instruments are under development at the IAC headquarters, for instance OSIRIS and EMIR. The IAC is also in charge of control systems of FRIDA.

- Universidad Complutense de Madrid (UCM, Spain). The Universidad Complutense de Madrid houses a group specialized in Data Reduction Pipelines and control software. UCM group is developing the EMIR and FRIDA pipelines. They had a strong contribution to the design and implementation of the GTC telescope Data Processing Kit.

- University of Florida (UF, USA). The University of Florida is one of the world's leaders in the construction of facility-class infrared astronomical instruments for large telescopes. Among the major instruments recently completed or in progress are T-ReCS and FLAMINGOS-2 for Gemini South, CanariCam and CIRCE for GTC.

- Universidad Nacional Autónoma de México (UNAM, Mexico). The IA-UNAM is a top-class Astronomy research institution in Mexico, and is involved in state-of-the-art instrumentation projects. The IA-UNAM operates the Observatorio Astronómico Nacional in San Pedro Martir, Baja California (OAN/SPM), and it is a partner of the 10-m class GTC telescope consortium. It also runs a graduate program in Astrophysics and divulging scientific and technological work, promoting wide science interest in the country.

- Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE, Mexico). INAOE is the lead Mexican institution for the Large Millimeter Telescope (LMT) and is partner of the GTC consortium. The institute is one of the research centers of the national science and technology council, CONACyT. With a staff of over 100 researchers in astrophysics, optics, electronics and computational sciences, INAOE is one of the most important research institutes in the country.

Partner Research Institutions

- Centro de AstroBiología (INTA/CSIC, Spain). The CAB (Centre of Astrobiology) is a mixed center INTA-CSIC located in the INTA campus. It is associated with the Astrobiology Institute of the NASA. Its research activity is focused on the origin of life and its presence and influence in the Universe. CAB Scientists and technicians are specialized in subjects such as astronomy, fluid dynamics, geology, biochemistry, genetics, remote sensing, ecology, computer sciences, robotics, etc.

- Instituto Nacional deTécnica Aeroespacial (INTA, Spain). INTA is a spanish public institution, specialized in aeronautic and aerospace research and development. Founded in 1942 within the Spanish Air Force, in 1977 came under the aegis of the Secretary of State for Defence of the Ministry of Defence, expanding the scope of its activities.



- **IScAI 2009 Board of Directors**

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