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# EST NewsLetter

## Editor's Corner



### EST Preparatory Phase begins! Manuel Collados Vera *EST Coordinator*

The European Commission recently notified the grant of 4 million euros to fund the proposal PRE-EST (Preparatory Phase for the European Solar Telescope) that formally initiated on Saturday April 1st at a meeting between its members in Madrid.

The European Solar Telescope is one step nearer to becoming a reality. As the project enters the preparatory phase, the technical office of the project will be set up, with a big team of engineers

to manage and supervise the final design and technical specifications of the telescope. This phase, which will last for four years, has the goal of establishing the plans for its construction and operation, as well as preparing the necessary legal and financial agreements among all the members involved in the project.

A further aim is to deepen industrial participation in the initial designs of the telescope and its subsystems, as well as performing a comparative study to determine whether it will finally be sited at the Teide Observatory (Tenerife), or the Roque de los Muchachos Observatory (La Palma). In addition, the project will achieve the legal, financial, and technical maturity required to ensure the successful realization of the EST project. The economic assistance from the European Union will be complemented by contributions from the host country and from the project members. The contribution of the local Government (of the Canaries) to PRE-EST from the beginning is also essential for the success of EST, and it is expected to be forthcoming in the near future.

## Next Events

### *RICH Symposium "Fostering the Innovation Potential of RIs"*

Lisbon, Portugal  
8 May, 2017

### *First China-Europe Solar Physics Meeting*

Kummin, Yunnan, China  
15-18 May, 2017

### *Adaptive Optics for Extremely Large Telescopes*

Puerto de la Cruz, Spain  
25-30 June, 2017

### *European Week for Astronomy and Space Science*

Prague, Czech Republic  
26-30 June, 2017

### *ESPM-15: 15th European Solar Physics Meeting*

Budapest, Hungary  
4-8 September, 2017

## EST News

### Status of the on-going European projects

The kick-off meeting of the **EST Preparatory Phase** (PRE-EST) was held last April 1<sup>st</sup> in Madrid with the participation of all partners. The meeting has been a good chance to consolidate the Consortium and to remarks project management key points. The PRE-EST Consortium encompasses 23 research institutions from 16 European member states being Instituto de Astrofísica de Canarias (IAC) its Coordinator (see the cover picture).

The main aim of PRE-EST, funded under the H2020 Framework for four years, is to provide both the EST international consortium and the funding agencies with a detailed plan regarding the implementation of EST. This will provide the information necessary for them to make decisions, addressing both organisational and technical issues as well as costs and risks analysis. Moreover, PRE-EST will lead the detailed design of EST key elements to the required level of definition and validation for their final implementation. To know more about the project, please visit the EST [website](#).

At the same time PRE-EST project started, SOLARNET celebrated the last board meeting in Madrid to review the main results achieved during the project lifetime. SOLARNET project, an I3 Trans-National Access network funded under the FP7, has ensured that all European solar physicists accessed the solar facilities and data archives and provided an ecosystem for collaborations aiming at the development of tools and prototypes for innovative solar instrumentation. Last, but not least, GREEST project has successfully overcome the mid-term review in Brussels.



### SOLARNET, four years of success

SOLARNET has enabled to bring together and integrate the major European research infrastructures in the field of high-resolution solar physics, in order to promote their coordinated use and development.

Thanks to SOLARNET, networking activities, access to first-class infrastructures and joint research and development activities have been carried out to improve, in quantity and quality, the service provided by this European community.

#### Networking Activities:

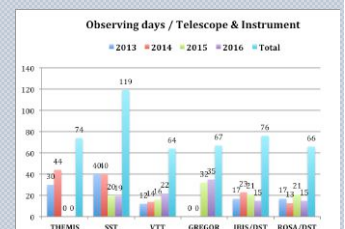
- Five Summer Schools and Thematic workshops were organized in Wroclaw, Granada, Tatranska Lomnica, London and Belfast with a total of 124 attendees (schools) and 194 participants (workshops).
- Four conferences held in Oslo (2013), Palermo (2015), Freiburg (2015) and Lanzarote (2017) with 357 attendees.
- 20 students, from 9 countries, have been supported under the Mobility of Young Researchers Program, with a total of 165 weeks (8,3 in average). As result of these international collaborations, six papers has been submitted or accepted.

#### Joint research and development activities

- A prototype of an Integral Field Unit (IFU) based on an image slicer has been developed and validated.
- The local seeing for two possible locations of EST has been monitored for a long period, to characterize the daytime atmospheric turbulence distribution.
- A Multi-conjugate Adaptive Optics has been simulated for EST for large range of possible scenarios and optical configurations.
- Solar observations from different instruments and sources are now accessible from a common interface to the scientific community thanks to the Solar Virtual Observatory.

#### Access to first class infrastructures

- A total 466 observing days has been enjoyed by the European solar community between 2013 and 2016.
- 353 researchers from 18 countries (5 non-EU countries) have benefitted from the access to the solar facilities of the Canary Islands observatories.
- Last, 59 observers of those were supported (travel and subsistence) thanks to SOLARNET.



## EST News

### Arctowski medal

Mats Carlsson and Viggo Hansteen, Professors at the Institute of Theoretical Astrophysics at the University of Oslo, received the 2017 Arctowski Medal of the U.S. National Academy of Sciences.

Working in collaboration, Hansteen and Carlsson led the development of the Bifrost numerical model of the solar atmosphere, a complex, three-dimensional magnetohydrodynamics model, which has vastly improved our understanding of the physics of the Sun, including its dynamic and constantly changing chromosphere, transition region and corona.

Carlsson and Hansteen's multi-faceted approach, which combines both modeling and observations, allowed Bifrost to solve decades-old mysteries of the chromosphere, such as the physical mechanisms that drive chromospheric and coronal dynamics and energetics. It has also provided key insights into solar features such as the short-lived bursts of gases known



as spicules, the micro solar flares known as Ellerman bombs, chromospheric surges, and coronal flares. Among its many applications, the constantly evolving Bifrost code has played a central role in NASA's Interface Region Imaging Spectrograph (IRIS) satellite project, which is exploring how the solar atmosphere is energized.

Mats Carlsson and Viggo Hansteen participate actively in the development of the future EST as members of the European Association for Solar Telescopes (EAST). Indeed, Mats Carlsson is the current EAST president.

### ERC grants in Solar Physics

Javier Trujillo Bueno (IAC), member of the EST team, has recently been awarded a prestigious ERC Advanced Grant. Among the most prestigious grants in Europe, ERC funding is only awarded to academics at the frontier of research, with several Nobel laureates among past grant-holders.

The project will allow him to carry out pioneering research for five years on the polarization of solar radiation and magnetic activity in the solar atmosphere. This is the first time that a Spanish scientist has obtained an ERC Advanced Grant in the field of "Science of the Universe".

Other solar physicists as Sami Solanki (MPS), Mats Carlsson (UiO), Lena Khomenko (IAC) or Markus Roth (KIS), all members of EAST community, have been funded in the last years with this prestigious grants from the European Research Council. Undoubtedly, these groundbreaking projects will improve our understanding of the solar magnetism and provide diagnostic techniques to interpret the spectropolarimetric data of unprecedented quality to be provided by the new 4-m class ground-based telescopes as EST.



■ The POLMAG project (*Polarized Radiation Diagnostics for Exploring the Magnetism of the Outer Solar Atmosphere*) is aimed at the development of new methods for investigating the magnetism in the outer layers of the solar atmosphere (chromosphere and corona) based on the measurement and the theoretical interpretation of the polarization of the radiation in the solar spectrum.

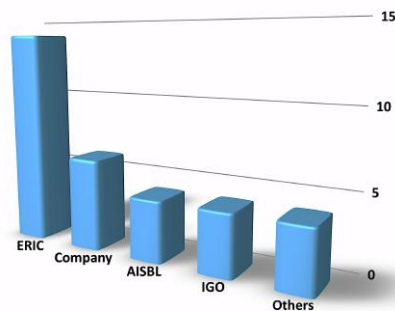
The results may open a new window of astrophysical research with important implications for our understanding of the Sun and its magnetic activity.

Winning this Advanced Grant is a new success for the Solar Physics group at the IAC, which is also the driving force behind the project to build the EST, one of the European strategic projects, which should be built at the Canary Island Observatories.

## Related Project Outputs

### Future legal form of EST

Aware of the relevance of the legal structure and governance rules in the establishment of a large research infrastructure, EAST has already devoted some effort to address those aspects. Recently, as part of the objectives of GREEST project, the consortium has analysed all alternative scenarios based on the experience of existing ESFRI projects. The resulting conclusions will be taken into account during the EST Preparatory Phase and will certainly help to reduce, or avoid, a harmful temporary gap between the preparatory phase and the construction phase. Most of the ESFRI infrastructures have chosen a **European Research Infrastructure Consortium (ERIC)** as legal body. A total of 14 infrastructures have opted for an ERIC body, while other 10 proposals are under preparation or evaluation. Indeed, the ERIC Regulation was adopted to facilitate the establishment and the operation of large European research infrastructures amongst several member states and associated countries, and counts thus with the greater political visibility as implementation of the legal form designed by the EC.



An ERIC has legal personality based on European law providing:

1. Full legal capacity recognised in all EU member states allowing the participation of associated countries, third countries and intergovernmental organisations;
2. Flexibility to adapt to the specific requirements of each infrastructure, leaving the members to define in the statutes, case by case, membership rights and obligations, bodies and competences;
3. Some privileges and exemptions allowed for intergovernmental organisations;
4. A faster and more cost-efficient process than creating an international organisation.

A high level national representation is preferred for reasons mainly of financial sustainability, preferably on a governmental level, and into the framework of an ERIC entity. Such a representation has its drawbacks on the negotiation process. However, this can be circumvented by establishing an interim entity during the preparatory phase and, from there, develop arrangements on an intergovernmental level and prepare the ERIC application. For an adequate management of the preparatory phase and also to guarantee a smooth transition to the final legal body, the main governance bodies could be established in clear alignment to the ERIC Regulation. This hybrid structure should be very well suited to accommodate such evolutionary model.

### SOLARNET IV meeting

The 4th SOLARNET meeting "*The physics of the Sun from the interior to the outer atmosphere*", organized by the Instituto de Astrofísica de Canarias (IAC), took place last January in Arrecife (Lanzarote). The main purpose of this conference was to provide a coherent picture of the Sun as a single physical system playing all the underlying physical processes measured and observed in the solar atmosphere to date.



The congress was an international meeting point for the astrophysical community at all levels, from doctoral students to experienced researchers, in which the most recent advances were discussed.



The sessions were dedicated to different topics related to Solar Physics, such as the study of the interior of the Sun, the formation of spots and active regions and the links between the subsurface dynamics and coronal mass ejections.

The meeting included a special session dedicated to upcoming solar telescopes and instrumentation, such as the future EST.

It is worth noting the wide female participation in the meeting, whose scientific organizing committee was entirely composed of women.

## Knowledge for Innovation

### *GREST co-creation experience*

It is now well-known that science and technology have a major impact in our society. In particular EST, one of the most relevant research infrastructures for ground-based solar physics observations, is a highly technological project with an important impact in the private sector companies linked to it.

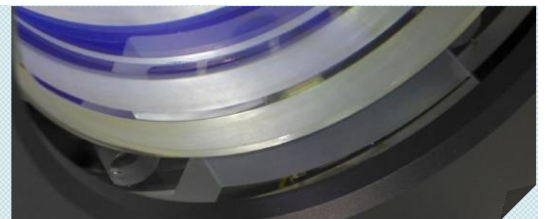
In the achievement of EST goals, new applications will come up during the development of breakthrough technologies, increasing the capabilities of the industrial sector and strengthening the cooperation between academia and industry.

In this context, the GREST project provides an excellent opportunity to European companies to increase their innovative capability level.

The feedback obtained from the research groups about the characterization, properties studies and detailed performance analysis of these technologies is also used to improve the company processes. This feedback would not be fostered without GREST where the synergies between public research and private companies are exploited. Last, the companies could not assume alone the high costs and risks associated to this kind of research.

#### LARGE APERTURE ETALON

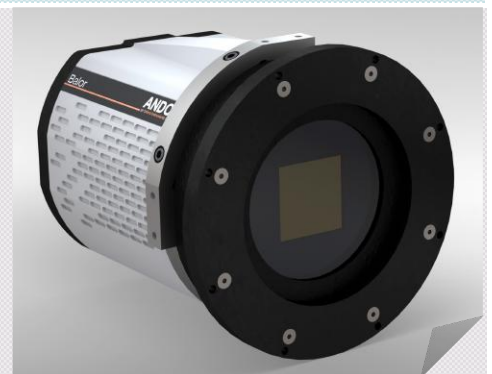
■ As part of the large aperture etalon, **ADS International** (Italy) has developed novel high performance capacitive sensor electronics. The current performances of the etalon controller electronics are definitely superior to the alternative products in the market. The co-innovation process undertaken by the company is providing new technical competences completing its capability to develop innovative instrumentation, as digital seismometers and high precision inclinometers, all based on the same sensor digital electronics here developed. As a matter of fact, these instruments have been identified as niche applications for which few suppliers are present at European level, thus providing a good opportunity for the company to increase its products offer.



#### LARGE FORMAT HIGH SPEED PROTOTYPE DETECTOR

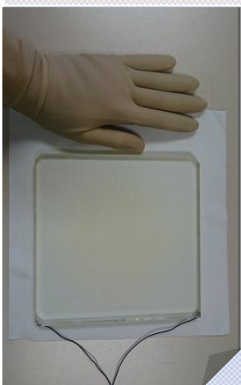
■ Future solar physics detector requirements are for large-format, high-resolution and high-cadence cameras to image solar dynamic features over large fields-of-view. Furthermore, the detectors have to be capable of operating under a wide range of photon levels, as not all measurements of the Sun are bright! Narrow band instruments in particular can drive photons down to the 10's per pixel level, requiring a low detector noise floor, coupled with high quantum efficiency.

**Andor Technology** (UK) is an EST industrial partner working on both back and front-illuminated next generation Scientific CMOS (sCMOS) devices to address these evolving solar imaging demands. First generation sCMOS detectors have yielded extremely impressive performance, combining 1-2 electrons rms read noise with fast temporal resolution (100 fps at 5.5 Megapixel) and high dynamic range capability. Unfortunately they have been developed primarily for microscopy techniques, and thus have relatively small pixels and limited field of view. The demands of the EST solar telescope, and other fast cadence astronomy applications, have inspired Andor to innovate a larger field of view, 16.9 Megapixel device, with larger pixel pitch, requiring implementation of a new and emerging data interface standard.



#### LIQUID CRYSTAL CELLS

■ The development of new types of liquid crystal cells, different from the standard ones, in order to obtain faster response times, is pushing forward the improvement of the manufacturing processes of **ARCOPTIX** (Switzerland), a GREST industrial partner. In addition, new procedures to obtain a higher homogeneity in the optical thickness are being developed which will also increase the performances even for the standard devices and the potential uses of these systems. In general, the company is improving its know-how in this field, which will lead in the future to produce better products. While liquid crystals have become attractive for applications such as diffractive optics, adaptive optics, or optical metrology, the range of possible applications is ampler, including diffractive optics for the generation of digital holograms or high-speed communication systems.



# EST Newcomers



**Alexander Bähr**  
*GREST Optical Engineer*

Alexander Bähr is a physics engineer with seven years' experience in the development and test of active pixel sensors. He is skilled in the conception, simulation and test of prototype devices as well as the design and operation of tailored test systems. He was involved in the test and improvement of advanced DEPFET devices for applications in X-ray astrophysics and the development of the WFI for the ESA satellite mission Athena at the MPE.

For GREST project, he is working on the high precision polarimetric camera system at the Max Planck Institute for Astrophysics. The main goal is the design of a DEPFET based active pixel sensor providing in-situ storage for four polarization states.



**Nauzet Vega Reyes**  
*GREST Opto-mechanical Engineer*

Nauzet Vega MSc in mechanical engineering, is specialized as Prototypes Technician " and is a CFD expert. Involved in astrophysics projects since 2007, he first worked on EMIR, a GTC cryogenic instrument, and led the anchoring and alignment of the telescope instruments. As a thermal engineer, he drove the EST heat transfer analysis under the SOLARNET project in order to find the optimum solution for the

telescope. Nauzet has also developed new tools to speed up processes and improve the quality of the thermal analyses.

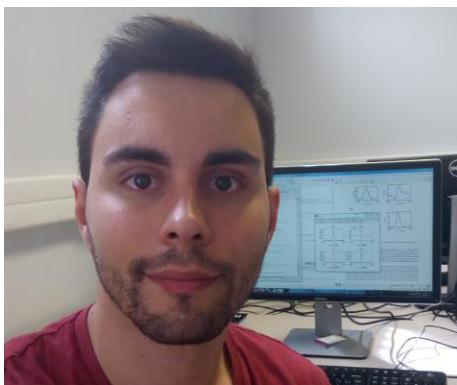
Nauzet is currently working as optomechanical engineer for GREST at the IAC. He was a key member in the team that developed the IFU prototype for GREGOR and successfully integrated it to the telescope in October 2016.



**Miguel Ángel Esteves Pérez**  
*GREST Mechanical Engineer*

Miguel Ángel Esteves Pérez obtained a degree in Industrial Engineering by University of Las Palmas de Gran Canaria (2010) and a MSc in Mechanical Engineering by University of the Basque Country (2011). After several years working for an aircraft constructor as stress engineer, he joined the IAC, where he has been since 2014.

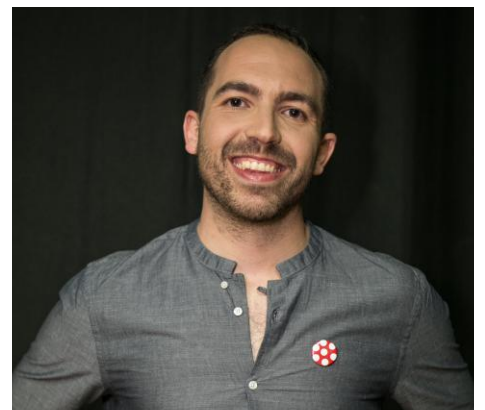
He has been involved on the structure design of EST as well as on the development of the Integral Field Unit (IFU) prototype, both activities under the framework of the SOLARNET project. He is skilled in design, manufacturing, integration, verification and testing, a valuable experience that will allow to undertake the objectives of the GREST project.



**Francisco Bailén**  
*GREST Optical Engineer*

Francisco Javier Bailén obtained a Degree in Physics from Universidad Autónoma de Madrid in 2015, and is currently about to finish a MSc in Optical and Imaging Technologies. He received several awards during his academic period, including two excellence scholarships and a special mention for Physics students.

His professional experience encompasses both fundamental research at the university, where he obtained a research fellowship in material simulations, with applied engineering at the private sector in the design of optical components for the automotive industry. He is currently working as optical engineer at IAA-CSIC, where he participates in the development of large format liquid crystal variable retarders that will be employed as modulators in EST.



**Manuel González**  
*PRE-EST Communication Officer*

Manuel González has a PhD in Astrophysics from Université de Paris-Sud XI and during the last years has been working as a postdoc at the Instituto de Radioastronomía Milimétrica (Granada), the Observatorio Astronómico Nacional (Madrid), and the Instituto de Astrofísica de Andalucía (Granada). He has a strong expertise in outreach activities, since he has been the responsible of the Spanish group of communication of the SKA telescope during the last year. Apart from that, he is a collaborator in some communication and outreach platforms, like Naukas (the most read scientific blog in Spanish).

As EST communication officer he will be in charge, among others, of the education, communication and diffusion activities of EST, as well as coordinating all communication teams from all the members of this pan-European project.

## Outreach & Dissemination

### *EST scale model arrives at IAC*

As it was mentioned in our previous issue, a model of the EST at scale 1:50 was under development, which is accompanied with augmented reality that highlights the main characteristics of the infrastructure. The model has been recently delivered to the EST team, and it is now located at Instituto de Astrofísica de Canarias in Tenerife, but it is expected to visit different museums and research centres in Europe. Indeed, after a short visit next June to Puerto de la Cruz (Tenerife, Spain) to attend the AO4ELT5 meeting, the model will be moved to the Museum of Science and Cosmos of Tenerife and after that the Museum of Science and Technology of Las Palmas de Gran Canaria. A short video of the development process can be seen in our [Youtube channel](#).

Within the context of the PRE-EST project, a new communication plan is being elaborated at the moment, which will include different activities like a documentary, a series of cartoon videos or a videogame. All of them are designed to increase the knowledge about Solar Physics in the general public, and to create awareness about the EST. To know more about the ongoing activities please visit the [EST website](#).



### *Stay tuned...*

In the coming months a large number of international events will take place, and many of them will see the presence of members of the EST team, starting soon with the First China-Europe Solar Physics Meeting. Below we highlight some of these events where anyone can learn more about the status of the project. Do not hesitate to approach us during these events in case you have any question about EST.

#### **First China-Europe Solar Physics Meeting. China, May 2017**

In order to broaden the collaborations and to exchange scientific results between Chinese and European solar physicists, both communities have reached an agreement on holding the serial China-Europe solar physics meetings every 2 or 3 years in China and European alternatively. It aims to strengthen the collaboration between European and Chinese scientists, in particular among young scientists. This will not only help development of solar physics in China and Europe, but will greatly contribute to the development of solar physics world-wide as well.

The meeting will be held in Kunming, China, from 15 to 19 of May hosted by Yunnan Observatories. Manuel Collados, EST Coordinator, will present the current status of the project. It is also expected that both communities will hold a meeting discuss possible effective avenues of collaborations within the framework of EST and to study the synergies in the development of innovative solar instrumentation.

### *EST presentations in international events...*

#### **Adaptive Optics for Extremely Large Telescopes Meeting**

Puerto de la Cruz, Spain. June 2017

EST Team

#### **EWASS 2017**

Prague, Czech Republic. June 2017

Jan Jurcak (ASU)

#### **15<sup>th</sup> European Solar Physics Meeting**

Budapest, Hungary. September 2017

Jan Jurcak (ASU)

#### **IAPSO-IAMAS-IAGA Joint Assembly,**

Cape Town, South Africa. August, 2017

Marian Martínez (IAC)

#### **Our mysterious Sun: magnetic coupling between solar interior and atmosphere.**

Georgia, September 2017

Manuel Collados (IAC)

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