Report on the 2011 Activities of the Center for Astronomy and Astrophysics of the University of Lisbon (CAAUL)

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General

The recent growth of CAAUL is reflected in the strong evolution in major topics which has attracted young researchers.
The Center has a very good scientific productivity and continues to have an active master and PhD thesis programme. It has substantially increased its participation in international instrumentation projects (ground and space) with a strong collaboration with the technical group (LOLS) of FCUL. The unit has been successful in securing funding grants from FCT, CERN and EU-FP7 for various scientific and instrumental projects. The proactive efforts of the Center in outreach activities are excellent, with participation of all the scientific groups. These outreach activities should have a higher visibility if the Center remains located at the Observatory.

In overall, the 2011 achievements are very good and impressive. In this report, we emphasize on recent scientific topics addressed to the Committee and detail some recommendations.

Scientific achievements

Planetary Atmospheres
The team comprises 5 staff and 4 students but yet no permanent researcher. They have participated in data analysis and modeling of several planetary missions such as Galileo, Cassini, Mars Express, Huygens and Venus Express. They obtained the leadership of observational projects in several ground-based observatories to complement the space data. They are most active in the study of Venus atmosphere with a general circulation model, as well as vapor abundance and atmospheric waves. Observations with the Visible and Infrared Thermal Imaging Spectrometer onboard Venus Express have been used to derive winds in the polar region of Venus. They are participating in the international coordination for the June 2012 Venus transit, and thus in the Venus Express legacy. In Portugal, they have a unique expertise in the field of planetary atmospheres and a permanent position is crucial to secure the future of the group.

Cosmology and Gravitation
The team comprises 8 staff, 2 post-doctoral fellows and 4 students. They are most active, have strong international collaborations and have presented a coherent roadmap. Their goal is to be increasingly involved in observational cosmology. The number of publications is impressive and already with a good citation index. They are involved in many projects, including inflation, scalar fields, dark energy, black hole collapse and cosmology, quantum field theory and weak lensing, cosmic shear. Several of their projects have been awarded CERN funding. They have regular seminars and have organized two internatinal meetings in 2011.
See below their involment in the EUCLID ESA M-class mission.

Formation and Evolution of Galaxies
The team comprises 4 staff, 4 post-doctoral fellows and 4 students. They aim at understanding the evolution of high redshift radio galaxies by now focusing on fainter radio fluxes and still higher redshifts. The Committee encourages the team to focus on research activities in line with the main observing facilities they are using and have a strong expertise on. The main observational approach is radio interferometry, thus their participation to the SKA pathfinfer EMU which will make a deep radio continuum survey of the southern sky. They are leading the working group on stacking of the radio maps. They also are involved in the WODAN proposal, a pathfinder similar to EMU for

the northern sky.
The proposal for a ALMA Regional Center node (ARC) in Portugal has been submitted autumn 2011, with a subsequent request for changes. Issues are the small size of the ALMA Portuguese community and the existence of a ARC node in Spain.

Participation in instrumentation projects

The Laboratory of Optics, Lasers and Systems (LOLS) of FCUL is available to CAAUL since 2009 to support the small technical team of CAAUL. LOLS helps in developing projects in optical engineering, optical metrology, optical navigation and instrument processors.
The instrumentation group within CAAUL has not yet been recognized by FCT. This group has been created after the last science evaluation by FCT. The Committee strongly hopes that the group will be well recognized by FCT at its forthcoming 2012 science evaluation.
Among the major and highly visible projects there are:
- ESPRESSO: echelle spectrograph with a resolving power of 120,000 to be mounted at the VLT Combined-Coudé Laboratory. Phase A was completed in 2010 and the project is in the implementation phase. First light on telescope is planned for 2016. With CAUP, CAAUL is part of an international consortium led by the University of Genève, and is in charge of the optical design and manufacture of the Coudé Train optics. This will be a major activity in 2012, with a FCT commitment of 970 kEuros.
- Gaia: ESA ambitious mission which will survey more than one billion stars and chart a three-dimensional map of our Galaxy. It will be launched in 2013. CAAUL is one of the four Portuguese members of the Gaia Data Processing and Analysis Consortium. LOLS-CAAUL has been involved (2007-2011) in the focal plane assembly static simulator, the optical ground support equipment (calibration and tests), simulation of images at the focal plan and the instrument model. There are plans for LOLS-CAAUL to be involved in the calibration phase after launch.
- EUCLID: space mission aiming at understanding the origin of the Universe's accelerating expansion using as cosmological probes weak gravitational lensing and baryonic acoustic oscillations. It will be launched in 2019. With CAUP, CAAUL(Cosmology group) joined on January 2012 the EUCLID consortium: a long term commitment with participation in the core science programme, the Survey Science Group (survey map group, survey planning tools and survey implementation group) and in developing a ground segment.
- PLATO: space mission aiming at studying planetary transits to characterize exoplanets and simultaneously measuring the seismic oscillations of their parent star. CAAUL is a member of the scientific consortium led by CNES and LOLS is in charge of data processing algorithms, attitude determination, reference systems definition and developing a ground segment. This mission has recently not been selected as a ESA M1-M2-class mission, and should be re-submitted for the ESA M3 mission call.

The Committee emphasizes that a phasing should be aimed at between the timing of missions (about at least 5 years for space missions) and FCT support available for 2 year periods only.

Recommendations

CAAUL is involved in excellent scientific and technical projects. It has a very good potential for development and its future overall objectives should be defined in a roadmap underlying the major projects with a strong, growing link between science and instrumentation development. To reach this goal the Committee suggests a strategic seminar to identify the top priority projects for the 2-3 coming years.
The OAL maintains a natural synergy with CAAUL, which is highly beneficial for both institutions. The rich historical setting is an asset to attract students in astrophysics.
The Committee is deeply concerned about the great difficulty to get new permanent positions: it may jeopardize the strong and enthusiastic efforts made by the Center.