RevMexAA (Serie de Conferencias), **24**, 29–32 (2005)

GTC AND THE UNAM ASTRONOMY

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RESUMEN

Se espera que GTC inicie observaciones en el 2006. Esta contribución examina el impacto que para el Instituto de Astronomía de la UNAM (IAUNAM) ha tenido hasta ahora su participación de socio con el Gran Telescopio Canario (GTC).

ABSTRACT

It is expected that GTC will start observation in 2006. This contribution examines the impact that participating as partners with the Gran Telescopio Canario (GTC) has had so far on the Institute of Astronomy of the UNAM (IAUNAM).

Key Words: **INSTRUMENTATION: MISCELLANEOUS — TELESCOPES**

1. INTRODUCTION

The IAUNAM manteins strong astronomy research lines and a vigorous postgraduate program. The IAUNAM has also decisively contributed to the development of other astronomy departments and institutes in Mexico. In order to expand its research programs, the IAUNAM had been seeking ways to participate as partner in a large class telescope. An attractive opportunity aroused with the advent of the Gran Telescopio de Canarias. It was only natural that when deciding on the participation of the IAUNAM in GTC more than one opinion was heard. The IAUNAM joined originally GTC mainly to provide its community of researchers and postgraduate students with access to a large telescope. The beginning of operations of GTC has been delayed for a number of reasons. It is now expected that GTC will start operations in 2006. When this happens, GTC shall provide IAUNAM astronomers and graduate students the opportunity of using the largest single ground based telescope in the world and state-of-the-art instrumentation. However, it is now clear that this partnership will not only mean access to a world class observational tool but it will also promote academic relations and mobility of visiting researchers and students among the GTC partners, namely, Spain, Florida and México. In addition, it has provided the opportunity for technical and science groups of IAUNAM to participate in the design, fabrication and assembly of instrumentation for GTC. The present contribution briefly reviews, from a personal perspective, the impact that for the IAUNAM has had so far, before first light, its participation in GTC .

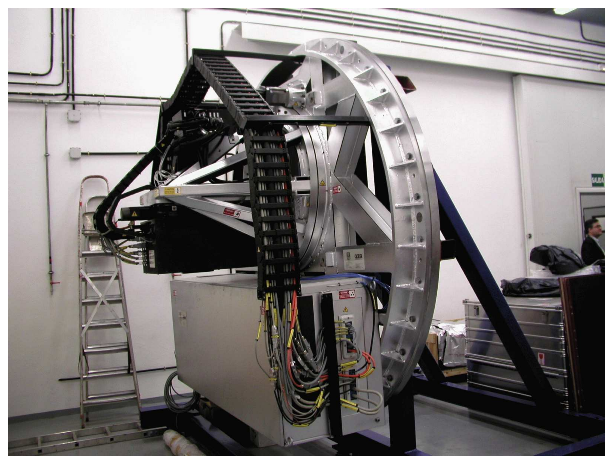

Fig. 1. The Commissioning Camera built by IAUNAM, stored at the GTC building in the Observatorio del Roque de los Muchachos, La Palma, ready to start first-light operations.

2. BEFORE DAY ONE

It is expected that GTC will have first-light by the third quarter of 2005. By fist-light the telescope and associated control systems should be fully assembled and under commissioning tests. Likewise, fine-tuning and calibration of the first instruments to operate with GTC will be performed right after first-light. GTC will reach day one, official start of observing programs, a few months later, in 2006. Clearly, we are not waiting to share in the excitement of participating in GTC until the telescope is ready to operate science programs, after day one. IAUNAM staff has been participating in projects related to GTC in the years leading to day one in two basic fronts: technology and science groups.

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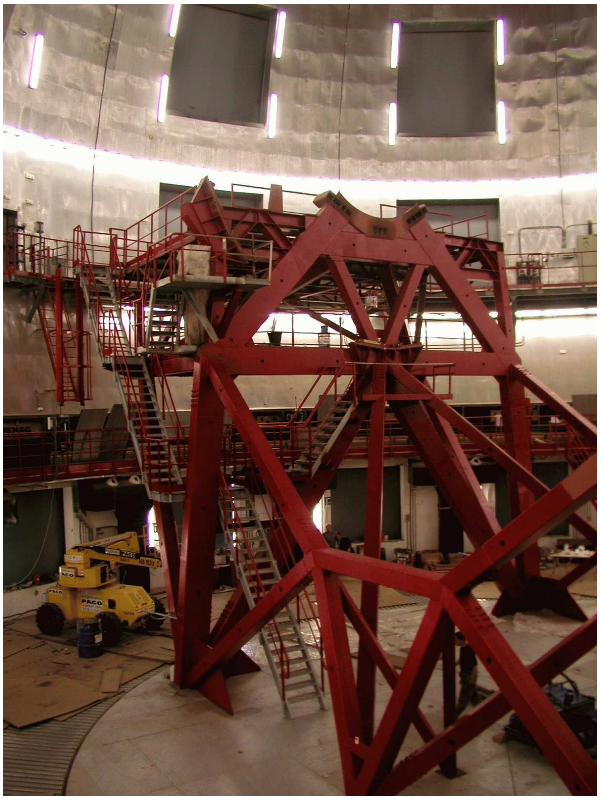

Fig. 2. A view of the support base and azimuthal structures and one of the Nasmyth platforms of GTC.

2.1. *Technology projects*

IAUNAM has directly participated in the development of two first generation instruments for GTC, namely: the Commissioning Camera and OSIRIS.

The Commissioning Camera was designed and built by IAUNAM in collaboration with CIDESI, an engineering and design center in Queretaro, Mexico, (see Figure 1). It has been delivered to GTC fulfilling all specifications and becoming the first generation instrument already in situ at GTC. This project took IAUNAM to a close and fruitful working relationship with CIDESI, with superb quality control standards. The ComCam experience has been a notable example of how basic science and Universities can successfully collaborate with high quality engineering local firms. These are important activities for UNAM.

OSIRIS is scheduled as one of the day one instruments for GTC. Its design incorporates a powerful camera with tuneable filters and low and intermediate spectral resolution capabilities. IAUNAM has participated in its optical and mechanical design and fabrication of some parts. Both of these projects, the Commissioning Camera and OSIRIS, with their respective delivery dead-lines and high technical specifications, have modified the programs, priorities, rhythm and work standards of a substantial part of the instrumentation group at IAUNAM.

Fig. 3. A view of the GTC dome with the supporting cell of the primary mirror in the foreground, soon to be integrated in the telescope structure.

For the second generation instruments of GTC, the IAUNAM is currently participating with the University of Florida and the Instituto de Astrofísica de Canarias in a collaborative proposal to build FRIDA, a near infrared camera and integral field unit with spatially resolved spectroscopy. FRIDA is designed to operate with diffraction limited optics and will be the first science instrument to be coupled to the adaptive optics system of GTC. The first ideas that lead to the concept of FRIDA emerged on one of the parallel workshop about adaptive optics. These have become studied in more depth at a later meeting in the GTC office in La Laguna among the GTC partners. A joint concept design proposal is now in preparation. In the case of IAUNAM, FRIDA will inherit much of the experience of the instrumentation group that participated in the Commissioning Camera. A stronger, more experienced and better organized technical and management group is the result of the previous participations in the GTC projects.

Works are proceeding at a fast pace now at GTC (Figs. 2 & 3) and the approaching first-light date will bring the instrumentation and science groups to hectic completions of their dead-lines and strategic science programs. Some groups at IAUNAM are aware of this fact and have started preparing science cases to compete for our share of the time. Research students are gradually becoming also involved. Observing proposals for a 10 m-class telescope need a different approach and preparation.

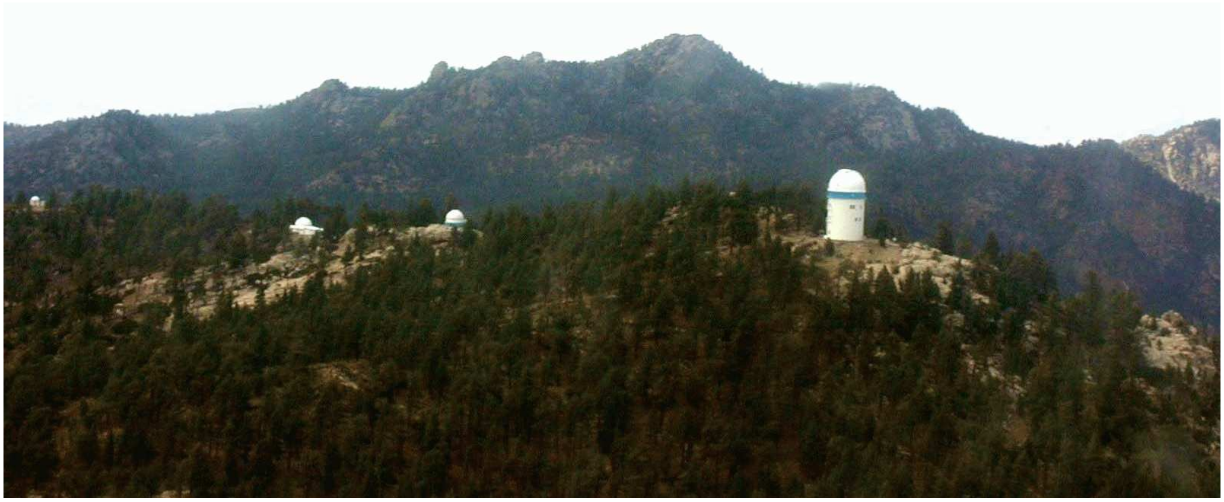

Fig. 4. A view of the Observatorio Astronómico Nacional in San Pedro Mártir. All facilities at the OAN have been built and are maintained by the IAUNAM.

2.2. *Science programs*

A number of astronomers from IAUNAM have become involved or interested in the science programs that are being developed for the first and second generation instruments of GTC. As it happens with the other GTC partners, the larger involvement from researchers and students is expected when GTC is in full operation. However, already several groups at the IAUNAM are anticipating the new possibilities that will bring GTC for their research areas.

The participation of IAUNAM astronomers in science groups related to GTC are distributed in the following fields: Stellar populations in early-type galaxies and star formation history. The environment of radio loud and quite quasars at large z (3 - 4). Environment evolution of the early universe. Search for proto-galaxies at z 4 - 6 by gravitational lens amplification. Physical properties of galaxy clusters acting as lens. The nature and characteristics of the diffused ionized gas in galaxies and its variation with galaxy morphology. The nature of the very extended emission line regions associated with active galactic nuclei. Survey of extra galactic planetary nebulae compiling abundances and ionization structure information; nebular properties with different stellar populations. Star formation history and chemical evolution of galaxies. Physical processes in circumstellar and circumnuclear environments at high spatial resolution, accretion disks, colliding winds and collimated ouflows. Physics of the ISM and star forming regions.

The science and technical contributions from IAUNAM staff in this workshop are good examples of the interests and participations mentioned in the previous paragraphs. Therefore, it is clear that the anticipation of GTC in the UNAM community has already had an impact on local science and instrumentation programs, even before receiving a single photon from GTC.

2.3. *Postgraduate students*

The postgraduate program in Astronomy includes students from the three UNAM astronomy centers, namely, Mexico city, Ensenada and Morelia. This year thirty six students are registered in the MSc programs and 21 students in PhD programs, for a total of 57. GTC will be a tremendous opportunity for them, however it is understandable that only very few of them at this stage are related, mostly indirectly, with GTC. Nevertheless, this situation must change in the near future, when GTC is operating. One of the best pay-backs we will have from our participation in GTC is the opportunity that it will provide to the new generations of Mexican astronomers. GTC should allow students to upgrade their thesis and research programs to compete at a world-class level. This is an excellent opportunity for the next generation of Mexican astronomy to catch-up with large-class telescope astronomy. It should also serve to prepare more young astronomers to participate in the future developments of our observatory in San Pedro Mártir (Fig. 4 & 5).

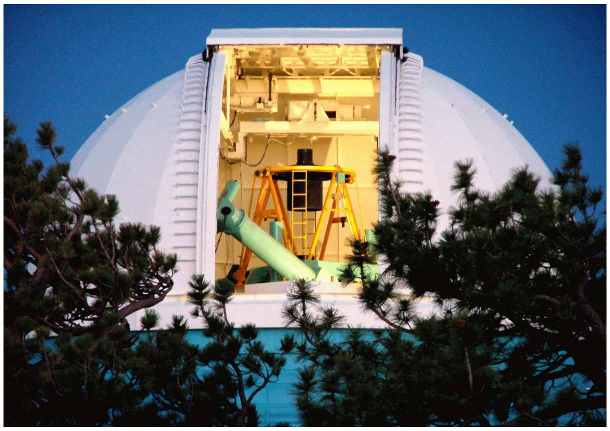

Fig. 5. A view of the 2.1m telescope at San Pedro Mártir.

3. AFTER DAY ONE

I thought appropriate for this second GTC workshop to evaluate our participation, as IAUNAM, in GTC. The facts show that even before arriving to day one, before any photon has been delivered and consequently before any real science has actually been done yet with the telescope, the participation in this project has already proven fruitful for the IAUNAM. Of course we all want those photons as soon as possible and we want to be able to get our science programs going. Day one is coming and when that happens, similar reviews to this one will have the science results for evaluation in the forthcoming GTC workshops.

I gratefully acknowledge the continuous financial support from DGAPA-UNAM and CONACYT (Mexico). I would also like to acknowledge the hospital of the Physics and Astronomy Department of the University of Manchester, where this contribution was finished. The Royal Astronomical Society and the Academia Mexicana de Ciencias have provided the necessary funds for an extended visit to the UK and their support is deeply appreciated.

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