Introducing the Isaac Newton Group of Telescopes

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**Abstract.** A brief introduction to the Isaac Newton Group of Telescopes and the Roque de los Muchachos Observatory on the island of La Palma is presented. Examples of the excellent observing conditions are given, and the focus of future instrumentation developments is set out.

1. **Introduction**

The conference *The Central Kiloparsec of Starbursts and AGN* is the first large-scale scientific conference hosted by the Isaac Newton Group of Telescopes (ING). Over the years the telescopes belonging to the ING have contributed considerably to this active and exciting field of research. It is therefore appropriate that a brief introduction to the observatory and the telescopes is given.

The Isaac Newton Group of Telescopes was set up in the early 1980s as the flagship northern-hemisphere optical observatory for the United Kingdom and The Netherlands through a bilateral partnership between the national research councils, now the UK Particle Physics and Astronomy Research Council, and the Netherlands Organization for Scientific Research. The ING comprises three optical telescopes, the 4.2 m William Herschel Telescope (WHT), the 2.5 m Isaac Newton Telescope (INT) and the 1 m Jacobus Kapteyn Telescope (JKT), located on the Roque de los Muchachos Observatory on the island of La Palma (Fig. 1). The WHT has now been in operation for nearly 15 years, indicative of the relative youth of the observatory. The ING telescopes have played a central role in the success of astronomical enterprise in the United Kingdom and The Netherlands, as well as in the host country, Spain.

Scientific productivity of the telescopes, in particular that of the WHT, has been extremely high (both in quantity and quality) to international standards. This was recently borne out in a comparative study by Benn & Sánchez (2001). This and previous studies have shown that the William Herschel Telescope is one of the most scientifically productive telescopes, with well over 100 papers produced each year in refereed journals. But more importantly, the scientific impact of the WHT as measured by the annually top cited papers, or by the number of papers published in *Nature*, ranks amongst the highest of all ground-based telescopes (Fig. 2).
Figure 1. Aerial view of the Isaac Newton Group of Telescopes at the Roque de los Muchachos Observatory, with the dome of the William Herschel Telescope on the right.

Figure 2. Number of papers from different telescope facilities, published in Nature during the 1990s. Data taken from Benn & Sánchez (2001).
2. Roque de los Muchachos Observatory

The Observatory on La Palma hosts a large number of astronomical facilities and brings together scientists and engineers from many European countries. Nighttime and solar telescopes are in operation, but also high-energy cosmic ray experiments are set up. This renders the Observatory one of the main centers for ground-based astronomy in the world, and certainly the main center on European soil. This success is largely promoted by the excellent atmospheric conditions of the site.

The Observatory site is operated by the Instituto de Astrofísica de Canarias, and its management is overseen by an international scientific committee. The facilities at the Observatory, however, are operated and controlled independently by the owners.

For sun-lovers it may not come as a surprise that the weather conditions on the Canary Islands are good. But astronomical reality is a bit more subtle. The Island of la Palma enjoys a fairly unique natural environment. The steep and high mountainous island, combined with stable trade winds and a low-altitude inversion layer are responsible for the often cloudless skies at the mountain top. In particular, the Observatory is known to enjoy very good seeing conditions with an all-year medium value of just under 0.7 arcsec, and even better in summer (Fig. 3). Both nighttime and daytime observing conditions are generally excellent. Furthermore, the night sky is very dark and strict government laws control external lighting and limit light pollution on La Palma in a very effective way.

3. Instrumentation Developments at the William Herschel Telescope

Rapid developments in technology and in the construction of several 8 m class telescopes imply that ING's telescopes have to adapt to a new scientific role for the future. This future central role of the WHT is seen to focus on two strands: i) exploitation of adaptive optics, in particular at visible and near-IR wavelengths, and ii) multi-object spectroscopy over a wide field. Both these areas provide important science capabilities competitive with, and complementary to, those at larger telescopes, and with the various imaging survey activities that are ongoing or are being planned. With these areas of focus the WHT optimally exploits the excellent properties of the La Palma Observatory site and the quality of the telescope and its infrastructure, whilst offering a long-term development path that provides important instrumentation capability to the astronomical community. Besides its core suite of facility instruments, the WHT is also expected to remain a useful platform for deployment of fast-track private instruments to tackle specific scientific problems.

Adaptive optics instrumentation is now an integral part of a still small but growing number of telescopes around the world. The WHT has joined this group with the recent delivery of NAOMI, a common-user adaptive optics system. First commissioning results have shown the potential of NAOMI in delivering diffraction-limited image quality. The scientific gains from image quality that defeats atmospheric turbulence are huge. Clearly observations from space are hard to beat from the ground, even with adaptive optics, except where novel
instrumentation and a large telescope collecting area provide the cutting edge. This is where the WHT will be competitive. In this field the WHT can compete very well with the larger telescopes, in particular at optical and near-IR wavelengths. The WHT, located at a site with excellent seeing conditions, is well positioned to build its scientific use on AO techniques. For these reasons, exploitation of excellent image quality through AO is central in the development plans for the WHT.

The WHT as a platform for proof-of-concept and fast-track visiting instruments has proven very popular in the past and is likely to remain popular in future years. The much lower cost of developing instruments for 4 m class telescopes compared to 8 m class telescopes, combined with the access to large amounts of telescope time makes the WHT an attractive platform for groups that build and exploit instruments. Notable examples of recent successes in this respect are the SAURON integral field spectrograph (a Netherlands, UK and French collaboration), built specifically to study the central areas of nearby galaxies, and the ESTEC-built SCAM imager using the novel super-conducting tunnel junction detector that allows CCD-type imaging with photon-counting and energy discriminating capability all in one.

This instrument development focus would ensure that also in the future the WHT would continue to contribute to uncovering the physics of the central regions of galaxies. For example, adaptive optics combined with spectroscopy allows studying the kinematics and composition of the cores of galaxies in much finer details while novel, dedicated instruments such as the SAURON integral field spectrograph provide a huge multiplex advantage allowing astronomers to survey large numbers of galaxies.
4. Future Developments at the Observatory

The Roque de los Muchachos Observatory is currently one of Europe’s most important astronomical observing sites. Ongoing developments of new facilities ensures that the Observatory will remain at the forefront of astronomical enterprise, and will further strengthen scientific collaboration on a European scale. In particular two facilities currently under construction that will have great impact are the Spanish-led 10 m Gran Telescopio Canarias (GTC) and the collaborative 17 m Čerenkov Telescope, called MAGIC.

Looking ahead, plans to develop a European 50 m Extremely Large Telescope may well come to fruition on La Palma. Such a great endeavor would most certainly involve many European countries and firmly place La Palma Observatory as Europe’s premier northern hemisphere observing site.

References


From left to right: José Acosta Pulido, Juan Antonio González Hernández, José Antonio Fernández Arozena, Fernando Cabrera Guerra, Leopoldo Martín.
Part 1

The Central Kiloparsec