The 2.5-m Isaac Newton Telescope

The Isaac Newton Group of Telescopes (ING) consists of the William Herschel Telescope (WHT), the Isaac Newton Telescope (INT) and the Jacobus Kapteyn Telescope (JKT). The construction, operation, and development of the ING telescopes are the result of a collaboration between the United Kingdom and the Netherlands.

The Isaac Newton Telescope has a 2.54-metre primary mirror with a focal ratio of f/2.94. It uses a polar-disc/fork type of equatorial mount. Instruments can be mounted at the corrected f/3.29 Prime or f/15 Cassegrain foci. Total weight of the telescope is about 90 tonnes. The telescope is used for wide-field imaging and intermediate to low dispersion spectroscopy.

The Optics

The optical system of the INT is a conventional Cassegrain configuration with a paraboloid primary mirror and a hyperboloid secondary. The primary has a diameter of 2.54 metres (the original 98-inch primary mirror was replaced by a 100-inch mirror when the INT was moved to La Palma) and a focal length of 7.5-m. It weighs 4,361 kg, is made of Zerodur and has a negligible coefficient of expansion.

There are three focal stations of which the f/3.29 Prime focus (with focal corrector) and the f/15 Cassegrain focus are commissioned. The third, f/50 Coudé focus was never implemented. The Prime focus gives a unvignetted field of view of 40 arcminutes and Cassegrain, 20 arcminutes.

Both Prime and Cassegrain foci are equipped with instrument rotators and autoguiders. The autoguiders continuously analyse the image of a guide star and provide small corrections to the telescope tracking. That is their main function but they also monitor transparency and seeing. Pointing accuracy of the telescope is around 5 arcseconds and guiding accuracy is better than 0.3 arcseconds.

A Brief Chronology of the Isaac Newton Telescope

1642 Dec 25	Isaac Newton born.
1942	Tercentenary celebrations delayed because of war.
1945-6	Proposal for large telescope for use of all British astronomers.
1946 Jul 7	First day of official celebration of tercentenary of Newton's birth. Announcement that funds voted for construction of 100-inch telescope.
1949	McGregor Fund donates 98-inch glass mirror blank.
1959	Telescope ordered.
1965	First light at Herstmonceux, U.K.
1967 Dec 1	Telescope inaugurated by Queen Elizabeth II.
1981	Telescope shipped to La Palma.
1982 Dec	New mirror arrives on La Palma.
1984 Feb	First light on La Palma.
1984 May 29	First scheduled observer on La Palma.
1985 Jun 29	Royal inauguration of observatory.
1997 May	First commissioning of the new Wide Field Camera, a four CCD camera operating at the Prime focus.
1998	Observations of type Ia supernovae from 1992 reveal that we live in an expanding universe at an accelerating rate.

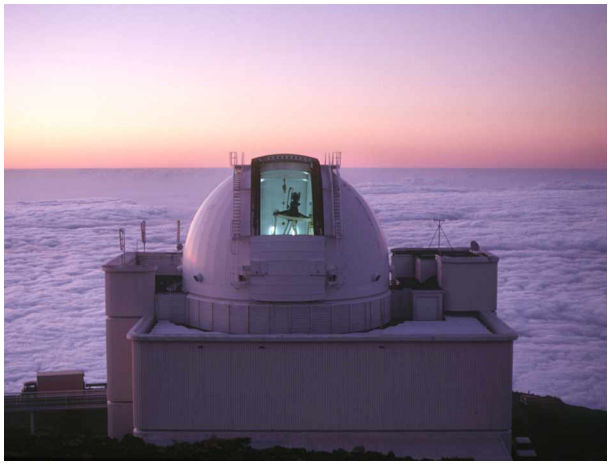
The Mounting

The telescope has a polar disc/fork type equatorial mounting supported by five axial and three radial hydrostatic oil bearing pads. The born-again INT, at La Palma, differs significantly in its mechanics, electronics and optics from the earlier incarnation at Herstmonceux, U.K. The change in latitude to 28 degrees 45 minutes has resulted in a large change of angle to the polar disc that stands almost on edge. A segment was removed from the disc in order to allow operation to a declination of -30 degrees.

The Instruments

The two common-user instruments at the INT are:

- The Intermediate Dispersion Spectrograph (IDS) at the Cassegrain focus, with a choice of two cameras of different focal lengths.



- The Wide Field Camera (WFC) at the Prime focus, a four CCD camera covering a 34 arcminute field of view. This new instrument offers unique opportunities to execute high resolution, deep, wide field optical imaging surveys.

Both instruments are fitted with state-of-the-art detectors, which record the spectra or images received. Current CCD (Charge Coupled Device) detector technology provides nearly perfect solid-state, digital detectors that are now widely used in astronomy and have replaced other light sensitive devices such as photographic plates.

Occasionally visiting instruments like MUSICOS, a fibre fed high-resolution spectrograph, or CIRSI, a wide field of view near-infrared imager, are mounted on the telescope.

The Control Systems

The telescope and the dome are normally operated by means of a dedicated computer, the so-called Telescope Control System (TCS), which resides in a temperature-controlled clean room on the INT building's second floor.

The telescope control room is located on the third floor of the INT building, on the north side of the observing floor and telescope. When entering the control room through the west entrance, we encounter the following (all on your right):

- The Instrument and Data Monitors. These units are part of the Instrument Control and Data Acquisition Systems (ICS and DAS respectively). The visiting and the support astronomers normally sit at these terminals.
- The Control Desk. This is the large panel with push buttons, TV monitors, keyboards, etc. It is the responsibility of the telescope operator. Nevertheless the TCS can be also operated from the ICS and DAS terminals allowing a more efficient way to observe.
- The Engineering Rack. A tall blue rack standing on the east side near the observing floor window. It serves for manual control of telescope functions during start up.
- The Weather Monitor. This tells the observer about conditions outside. Most annoying here are the humidity meter and the anemometer, which sometimes persuade the telescope operator to close the dome. This happens when the relative humidity is more than 90 percent or the wind speed rises above 80 km/h.

The Wide Field Survey

The ING's Wide Field Survey (WFS) makes use of the Wide Field Camera to carry out a range of sky survey scientific programmes. The WFS archive, started in 1998, contains (to March 2001) some 0.7 terabytes of reduced and calibrated image data on-line. This equates to some 2000 square degrees of sky coverage and currently represents the world's largest reduced (or ready for research) CCD sky survey available on the web.

The number of scientific highlights from the WFS has been very high and includes the first ever detection of a dark galaxy (a galaxy made of dark matter), the discovery of a low surface brightness dwarf galaxy nearby, and the discovery of many intermediate redshift type Ia supernovae which have helped astronomers to study in depth the recently discovered accelerated expansion of the Universe.