

SITE VISIT REPORT 2025

Instrument Centre for Danish Astrophysics

NORDIC OPTICAL TELESCOPE

Observatorio del Roque de los Muchachos (ORM),
Isla de La Palma, Canary Islands, Spain



A Historical Overview

The Nordic Optical Telescope (NOT) is a 2.56-m telescope located at an altitude of 2,382 m above sea level at Observatorio del Roque de los Muchachos (ORM), Isla de La Palma, Canary Islands, Spain (Position: $17^{\circ} 53' 06.3''$ W, $+28^{\circ} 45' 26.2''$ N). The telescope had 'first light' in 1988 and was officially inaugurated in September 1989. Regular observing started 1 April 1990.

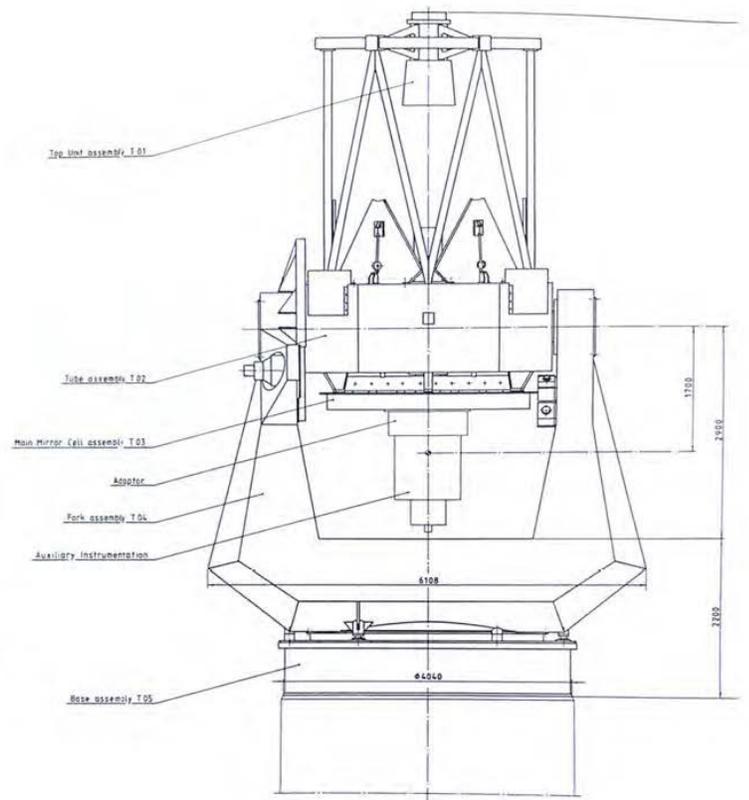
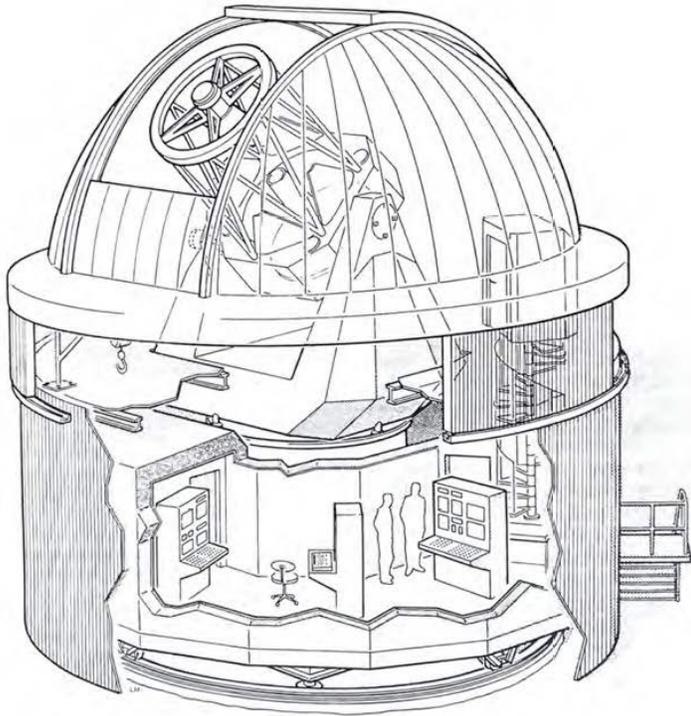


Design and Construction

The Nordic Optical telescope is a Ritchey–Chrétien telescope. The optical and mechanical design was made by Torben Andersen, and the mirrors were ground and polished at Tuorla Observatory, University of Turku in early spring 1988 by Tapio Korhonen. The mirrors are made of Zerodur glass, delivered by Schott Glaswerke in Mainz, Germany. The Zerodur glass has an exceedingly low thermal expansion coefficient, being around $1/100000000$ 1/K, or even lower.

For practical purposes, this is fully negligible if reasonable precautions are taken concerning temperature conservation of and around mirrors. The diameter of the main mirror is 2560 mm (Aspect ratio of 13.5. The weight of the primary mirror is 1925 kg) and the secondary mirror diameter is 510 mm. The focal length in the Cassegrain focus of the telescope is 28160 mm (effective focal ratio: f/11) resulting in a plate scale of 7.325 "/mm (136.5 $\mu\text{m}/''$).





The telescope has two instruments permanently mounted in a folded-Cassegrain focus. The folding mirrors allow the observer and staff to switch in short time from instruments mounted in the prime Cassegrain focus to either of the two instruments.

Installed Instruments

- **FIES:** A fibre-fed cross-dispersed high-resolution echelle spectrograph in the optical.
- **StanCam:** A CCD camera used for "target of opportunity" programs when no visual imaging instrument is mounted at the main telescope focus

The main Cassegrain focus contains one of the following two instruments:

- **ALFOSC** for UV-optical imaging and medium/low-resolution spectroscopy.
- **NOTCam** for near-infrared imaging and low-resolution spectroscopy.

Instrument changes can be done on timescales of hours (during daytime) and allow individual science programs to use several of the above instruments.

There are also two visitor instruments with limited access:

- **(DIPol-UF:** Three-band high-speed polarimeter
- **SOFIN:** Optical high-resolution spectrograph (Cassegrain focus)

A Premier Site for Astronomy

Atmospheric Stability & Clear Skies

- Located at 2,382 m above sea level, the NOT sits above the temperature inversion layer, offering clear, dry air. Over 80% of nights are ideal for observations, with low humidity—perfect for infrared astronomy.

Exceptional Seeing Conditions

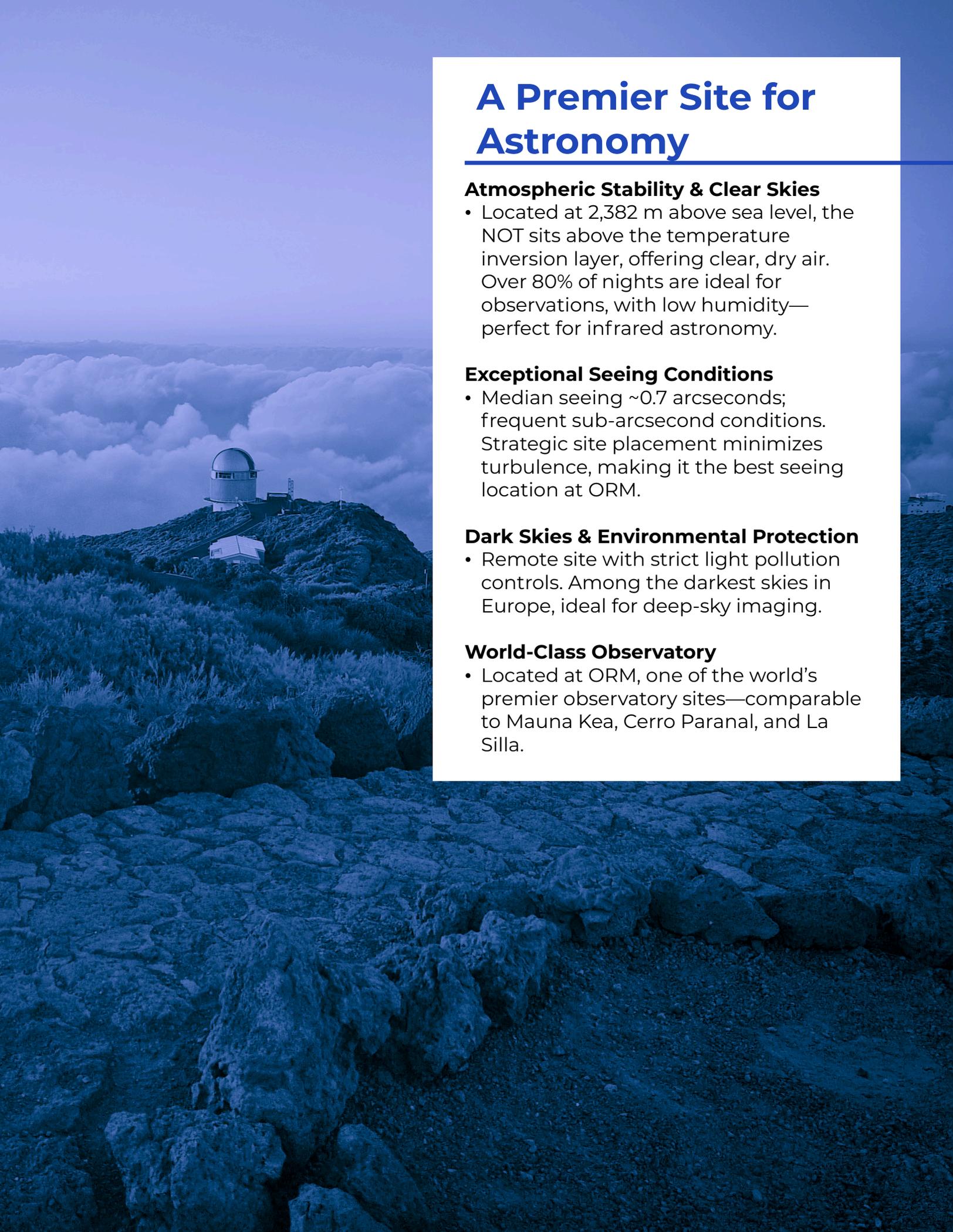
- Median seeing ~ 0.7 arcseconds; frequent sub-arcsecond conditions. Strategic site placement minimizes turbulence, making it the best seeing location at ORM.

Dark Skies & Environmental Protection

- Remote site with strict light pollution controls. Among the darkest skies in Europe, ideal for deep-sky imaging.

World-Class Observatory

- Located at ORM, one of the world's premier observatory sites—comparable to Mauna Kea, Cerro Paranal, and La Silla.



The Exceptional Observing Conditions

The Nordic Optical Telescope (NOT) is located at one of the world's best ground-based locations for optical and infrared astronomy. The combination of exceptional weather, a stable atmosphere, and dark skies makes the Observatorio del Roque de los Muchachos (ORM) – operated by the Instituto de Astrofísica de Canarias (IAC) – on the island of La Palma in the Canary Islands an outstanding site for high-quality astronomical observations. The specific placement of the NOT on a shoulder near the island's highest peak is scientifically optimal: this particular location has been shown to offer the best seeing conditions of the entire observatory.

At 2,382 meters above sea level, the Nordic Optical Telescope (NOT) is situated well above the temperature inversion layer created by the dominant northeasterly trade winds, which originate over the North Atlantic Ocean. These winds transport cool, moist marine air toward La Palma, where it rises along the island's slopes and cools further, leading to the formation of a dense layer of clouds. This moist air becomes trapped beneath a warm, dry air mass at higher altitude, creating a stable inversion layer. The base of this inversion typically lies between 1,000 and 1,200 meters and can extend up to 1,500 or even 1,800 meters during the winter months.



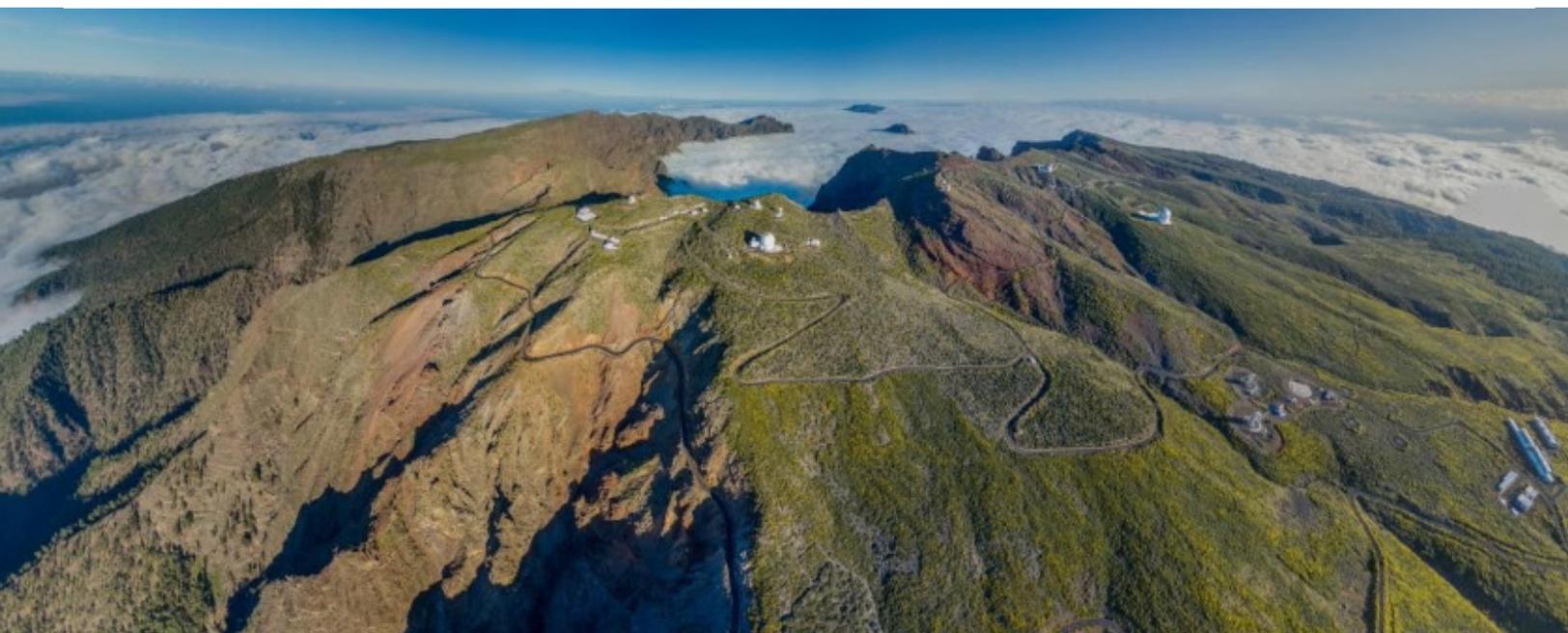
As a result, the low-level clouds are confined well below the altitude of the observatory, producing a dense layer of clouds that frequently covers the lower slopes of the island, while the summit remains in clear, dry air. This inversion effect is one of the key reasons why more than 80% of nights at the NOT are suitable for astronomical observations, with a high proportion of those being photometric – meaning completely clear, without even small clouds. Humidity at the site remains low and stable for much of the year, especially during the summer, which is particularly important for infrared observations. ORM also benefits from its remote location and strict light pollution regulations, offering some of the darkest skies in Europe.

What makes the NOT particularly special is its exceptional seeing conditions. The airflow and topography around the summit reduce local turbulence, resulting in a median seeing of approximately 0.7 arcseconds, with sub-arcsecond conditions occurring regularly. Long-term monitoring confirms that the specific site of the NOT experiences the most stable and



favorable atmospheric conditions of all telescope locations at ORM.

Very few observatories around the world can offer this unique combination of climatic stability, low atmospheric turbulence, and dark skies. The La Palma site rivals the performance of the world's top astronomical locations, such as Mauna Kea in Hawaii and Cerro Paranal and La Silla in Chile. For the Nordic Optical Telescope, this means that the observing conditions on a major fraction of nights meet the highest scientific standards attainable from Earth

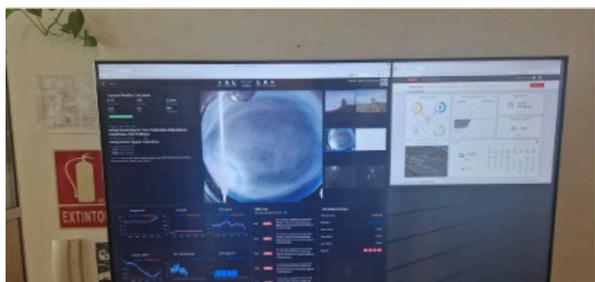
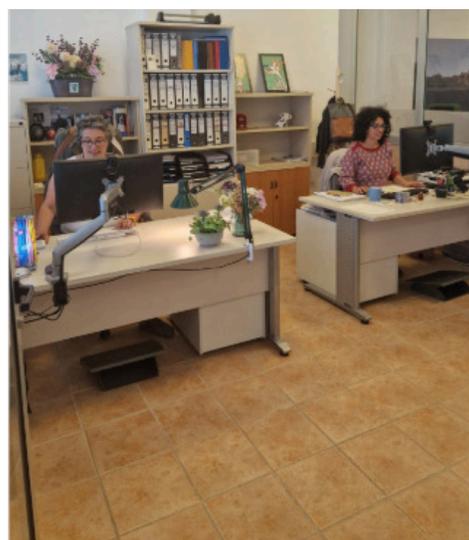
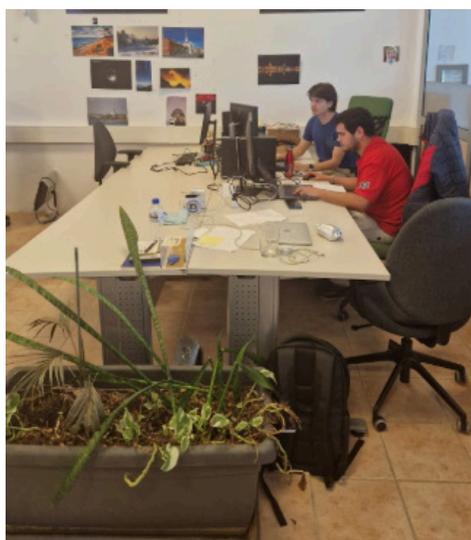


NOT Facilities and Operational Sites

The NOT organization operates both a sea-level office in San Antonio, Breña Baja—near Santa Cruz de La Palma, the capital of La Palma—and facilities at the observatory, where the telescope is located. The observatory site also includes a service building with office space and workshops. The sea-level office serves as the primary workplace for staff and students when

they are not working directly at the telescope site.

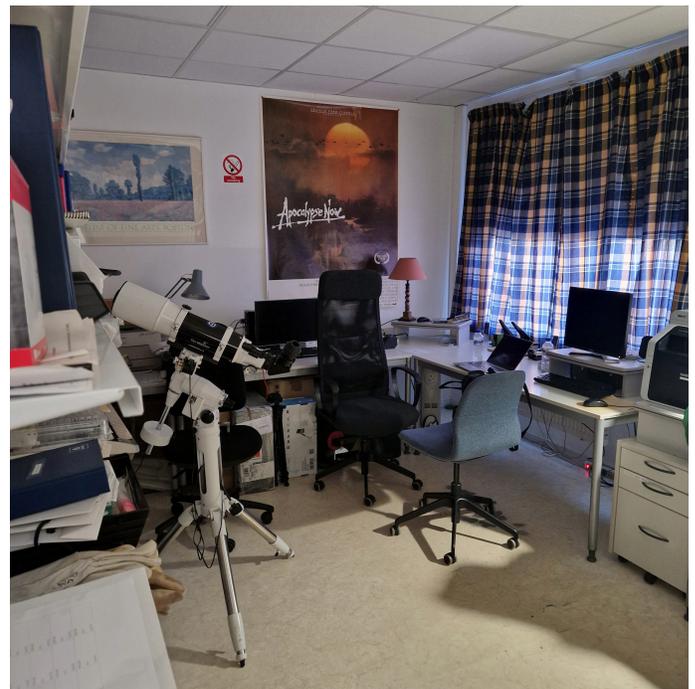
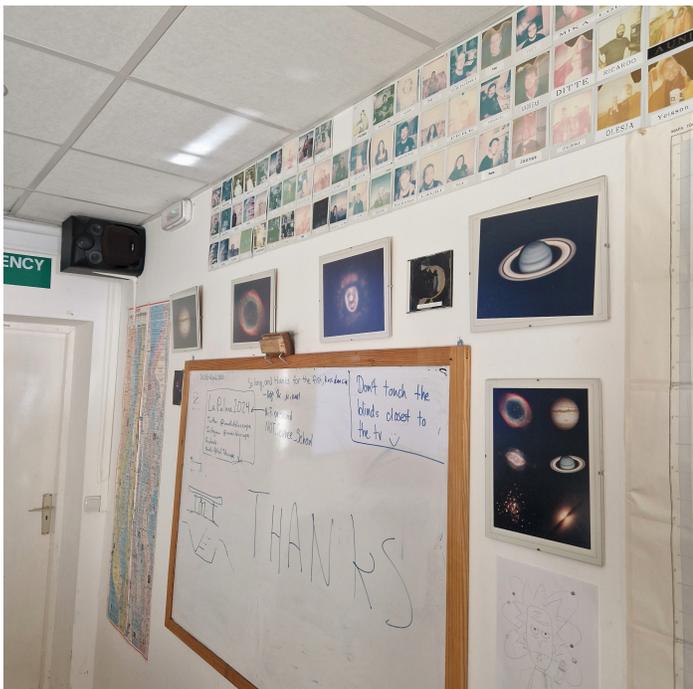
The purpose of the site visit on 28–29 April 2025 was to present the current status of the observatory facilities, including the sea-level office in San Antonio, Breña Baja. The images of the telescope shown below were captured during the visit on those dates.



Nordic Optical Telescope at Observatorio del Roque de los Muchachos (ORM)

On 29 April 2025, an external review panel, representatives from Turku University, and the Danish delegation from IDA, participated in the inauguration of the new solar panels installed on the main service building on the mountain.

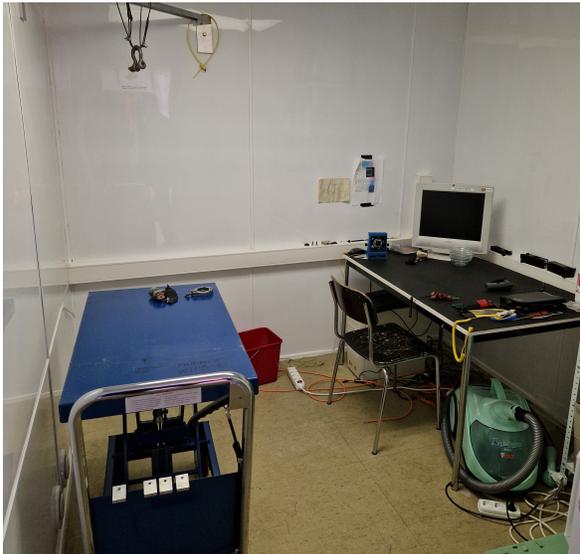




Service Building from outside and inside - work and office space



Mechanical workshop and workshop area



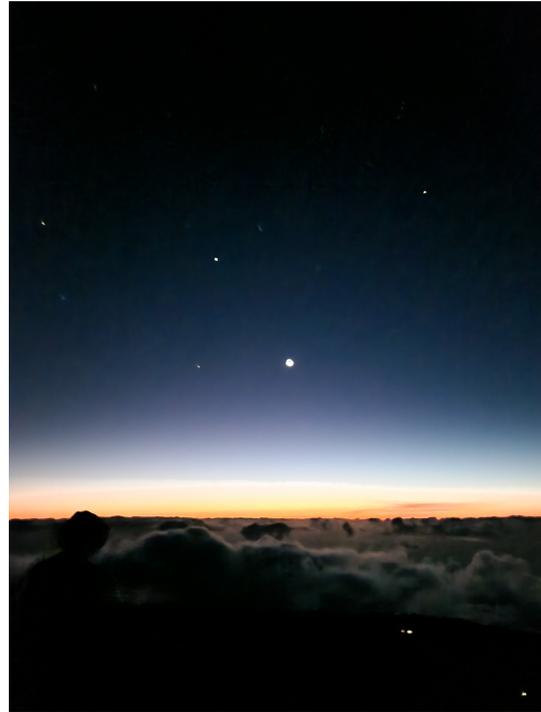
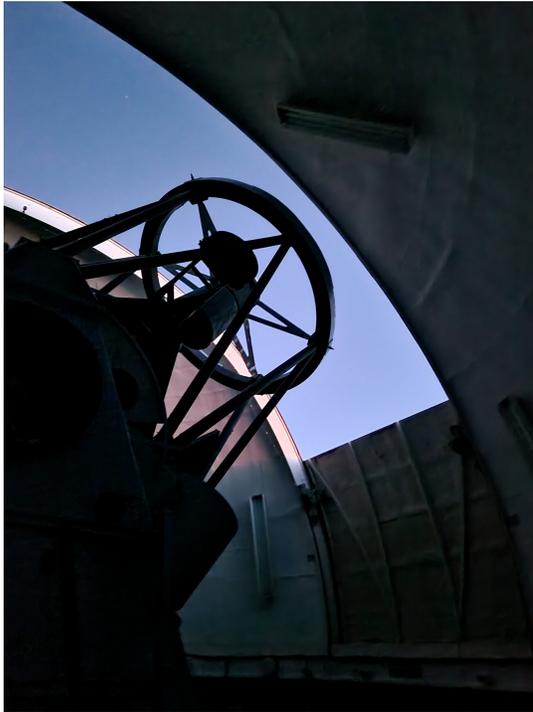
Clean room for instruments and the computers for data storage and basic processing



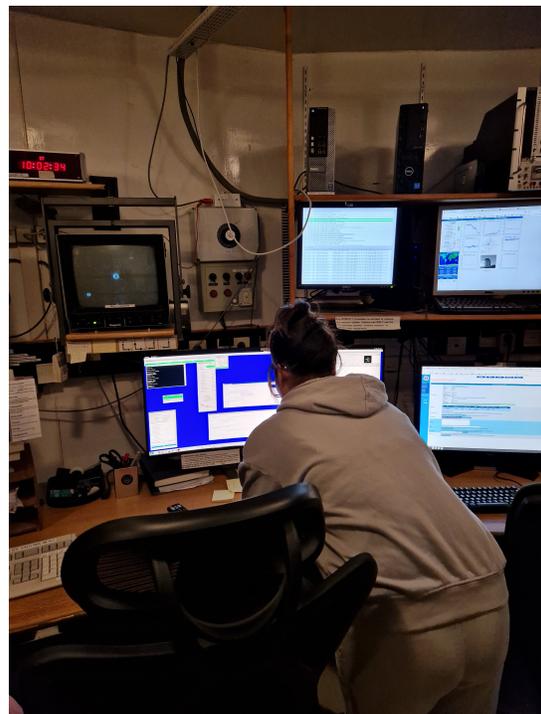
The telescope at the top of the mountain and the equipment used when aluminising the main mirror



The telescope entrance and the building for FIES - a fibre-fed spectrograph



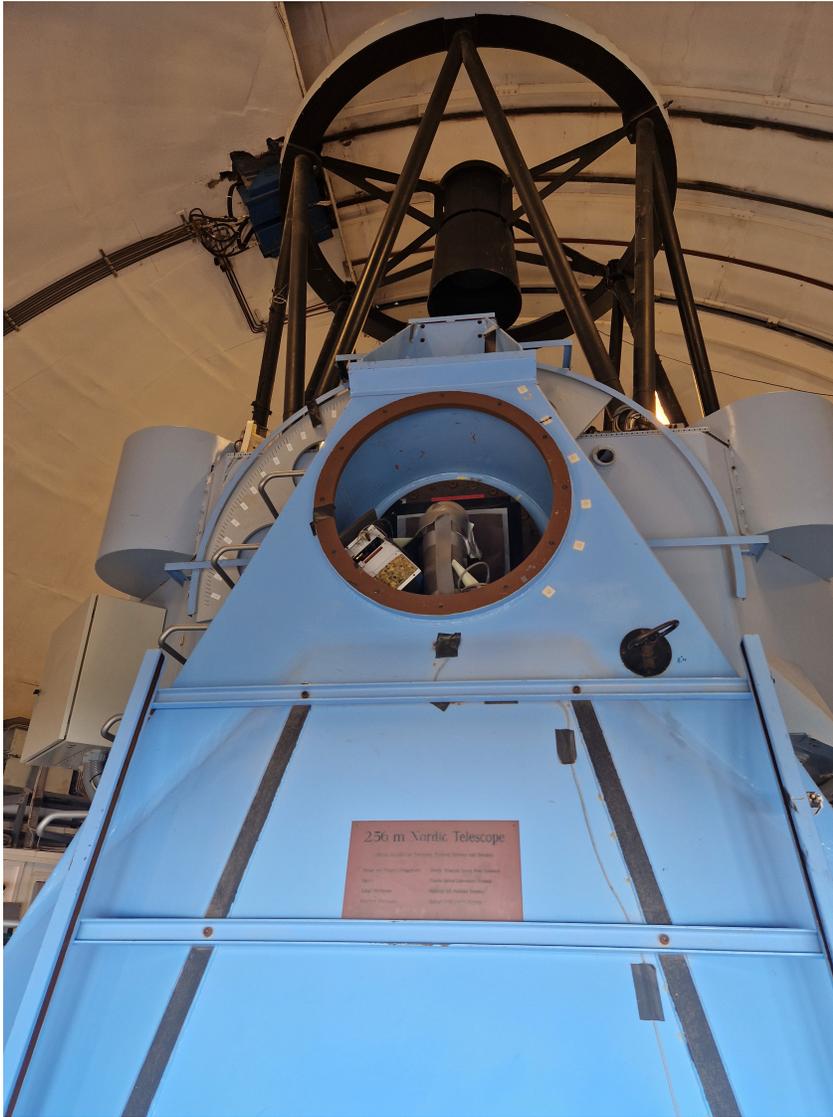
The operating telescope at night with the dome open



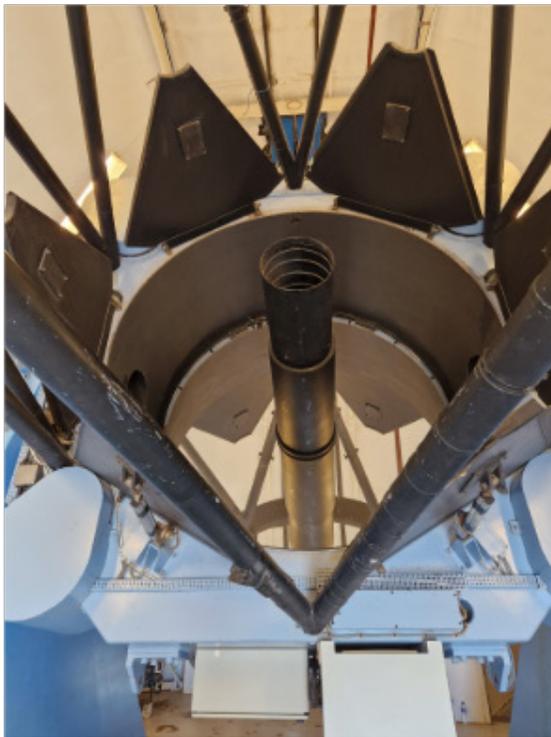
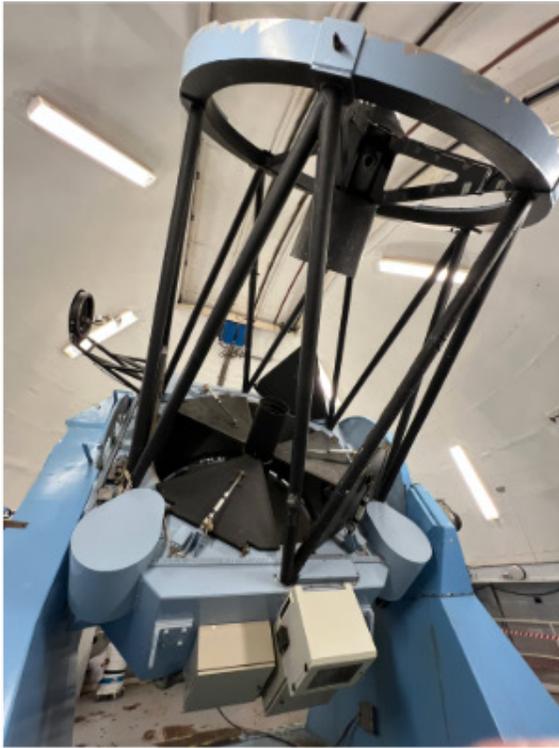
The control room in the dome, the TCS: Telescope Control system terminal and a NOT student setting up the telescope for an observing night on 29 April 2025



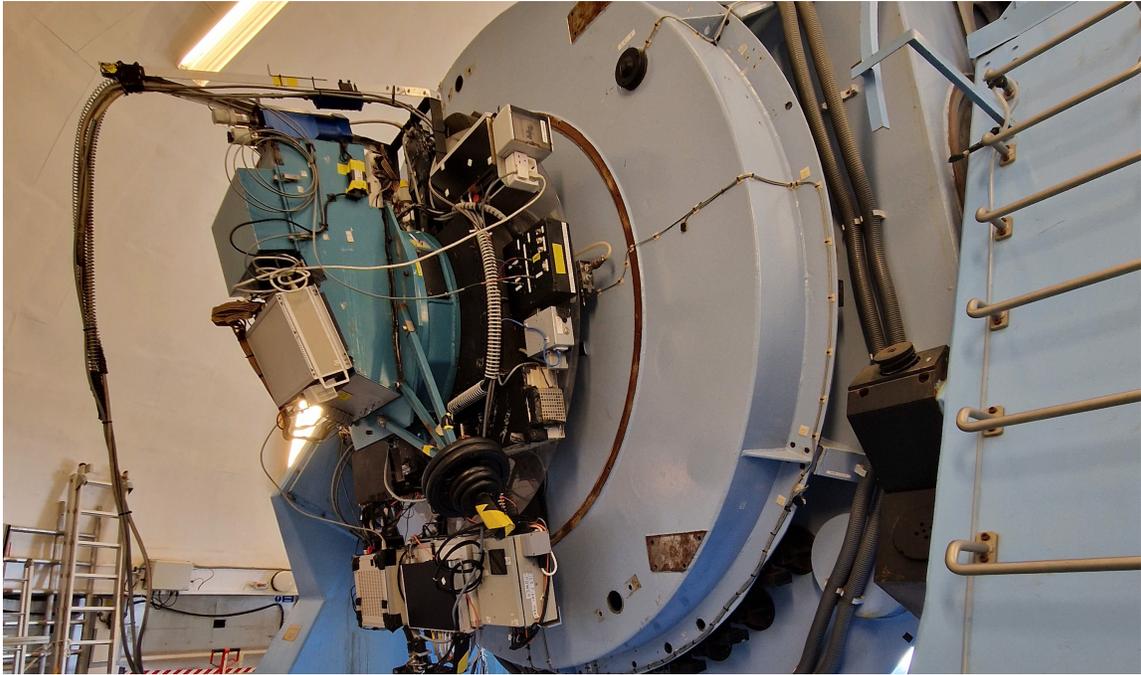
Main electricity system, computer room (TCS) and boxes with filters and grisms for the instruments.



A demonstration of its startup procedure and dome opening sequence.



The telescope in operation - from standard position to opening of the mirrors and positioning of the telescope.



The ALFOSC instrument at the Cassegrain focus at the Nordic Optical telescope.



The adapter plate of the telescope, onto which scientific instruments (such as NOTCam and ALFOSC) can be mounted at the focal point of the telescope. Additionally, the FIES Fiber Head POWER, which is connected to the FIES instrument, is visible within the adapter.



Instruments are stored at the observing floor in the dome of the Nordic Optical Telescope - ready to be mounted at the telescope adaptor plate. In emergencies a slide door in the dome can be manually opened and a rope ladder can be used for exiting the dome.



Site visit report made by
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