



*Dr. Álvarez, what is so special about the Gran Telescopio Canarias (GTC)?*

# In Search of Faint Objects

**Dr. Álvarez:** First of all its large diameter. The GTC, with a segmented mirror measuring 11.3 meters at its widest point and an equivalent diameter of 10.4 meters, will be the biggest telescope in the world. Its high image quality will be the best of the segmented telescopes currently in service. And it will have a high degree of availability for astronomic observations, with any possible "downtime" due to changes of configuration or break-downs reduced to the minimum.

*Which other telescopes will it be competing with and which will it be comparable with from point of view of its performance capabilities?*

**Dr. Álvarez:** The most direct competition for the GTC will be the two Keck telescopes which have a similar, although somewhat smaller, diameter. Nevertheless, the GTC has been conceived to provide the greatest possible scientific capability with the maximum possible reduction of the time required for adjustments, calibration or reconfiguration.

*Why did you opt for a segmented mirror?*

**Dr. Álvarez:** The segmented mirror is the only viable solution at the present time for diameters over 8 meters and the GTC was designed to have the biggest possible diameter within the project's time scale and economic limitations.

*How are the segments connected together?*

**Dr. Álvarez:** The segments are not connected to each other. There is a 4 millimeter gap between them. A sophisticated system of supports, drives and sensors will keep each segment in perfect alignment

with the others to provide the required hyperbolic surface.

*What was the reason for choosing "Zerodur" glass ceramic as the mirror carrier material?*

**Dr. Álvarez:** "Zerodur" is a material with a thermal expansion coefficient of practically zero. It is widely used in telescopes because of this feature, since changes of temperature around the telescope would otherwise produce slight distortions in the shape of the mirror. In the case of a segmented mirror like the GTC, variations to this coefficient of thermal expansion inside the material and the level of internal stress are especially important. "Zerodur" offers a high degree of homogeneity in its coefficient of thermal expansion and low internal stress and that is why it was selected as the material for the GTC's primary mirror segments.

*To what degree of precision will the segments be polished at REOSC?*

**Dr. Álvarez:** The segments will be polished by REOSC with a surface error of approximately 15 nanometers (1 nm = 1 millionth of a millimeter).

*How will the 42 segments be transported to La Palma?*

## High availability

Grantecan will minimize its downtime by means of

- automatic calibration simultaneously with the astronomical observation of the segmented primary mirror,
- single secondary mirrors for observations in the visible and IR range,
- tertiary mirrors which can be swiveled and rotated to guide the light bundle to the telescope's various instruments,
- a number of focal stations (7) for the permanent reception of the different astronomical instruments.

The outstandingly high image quality of the GTC will enable astronomers to explore other planetary systems.

**Dr. Álvarez:** They will be shipped by sea in containers, each containing six segments. The first shipment will arrive in La Palma in February 2002 and the last by December 2003. The instrument will then go into full service at the beginning of 2004.

*What new knowledge about the universe will we be able to obtain with the GTC?*

**Dr. Álvarez:** Like other large diameter telescopes the GTC will be capable of detecting very weak sources and distinguishing very fine details. This capability will be concentrated on the observation of very distant objects. This will provide invaluable information about the origin and development of the galaxies as well as the origin and evolution of our universe. It will also concentrate on objects which, although not very distant, emit very little light such as planets and brown dwarfs. There are many unknown facts relating to the formation of planetary systems and, to be able to find a solution, we need to be able to observe other planetary systems that are different to our own. This is only possible with telescopes like the GTC. The first stages in the formation of stars and their protoplanetary rings take place inside dense clouds of gas and dust. The GTC will be able to "penetrate" into the interior of these clouds and observe the details of these first stages, thus revealing the physical processes taking place there ■

*Computer simulation of the Grantecan on La Palma. The island is one of the best locations for astronomic observations.*

