

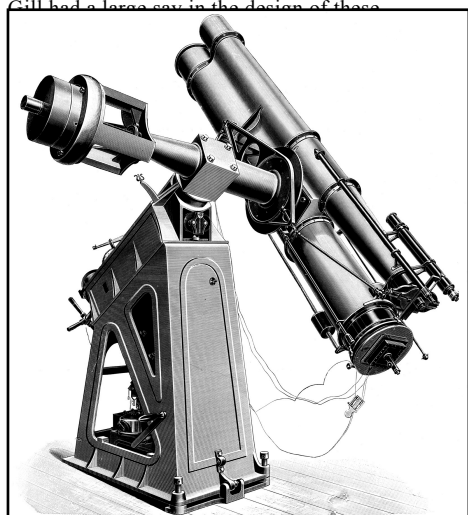
# Astrographic Telescope

## Origin – the Carte du Ciel project

Following Gill's success in photographing the stars, an international conference was held in Paris in 1887 at which it was decided that observatories worldwide should collaborate in making a new catalogue to be called the *Carte du Ciel* (Map of the Sky). The whole sky was to be photographed in zones using essentially identical telescopes at about 20 locations. The Royal Observatory Cape of Good Hope was assigned declinations from  $-41^\circ$  to  $-52^\circ$ .

The Cape Astrographic Telescope (*below*) and several others were made by Grubb of Dublin. It was completed in 1892. It has a 13-inch diameter main lens for photography in blue light as well as a 10-inch guider suitable for visible light. Its plate scale is 1 arcmin/mm and its field is  $2^\circ \times 2^\circ$ .

Gill had a large say in the design of these

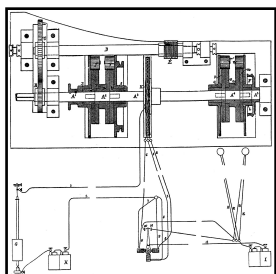


Above: The Astrographic telescope from a Grubb Catalogue.

The telescope drive was powered by a massive clockwork motor that was driven by a heavy weight. It was synchronised to the Observatory time system by phase-locking to a pendulum (*left*) whose bob passed through a blob of mercury. This produced an electrical pulse precisely once every second. On the drive shaft were three toothed wheels that also produced pulses.



If the drive was going well, the pulses from the middle wheel coincided with the pendulum pulses and nothing happened. However, if the pulses from the first wheel came before the pendulum pulses, a magnet engaged a planetary gear that slowed down the drive slightly. Similarly, if the pulses from the third wheel came late, another planetary gear was engaged to speed the shaft up.

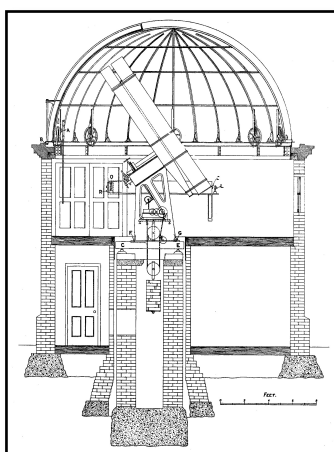


Left: the circuit diagram of the phase locking system. The three wheels are in the middle of the drive shaft, the planetary gears are at right. The pendulum is at bottom left.

## The Building



(Above) The Astrographic dome today.

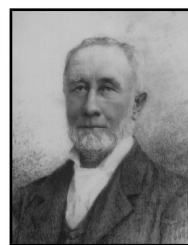


(Above) Cross-section of the building, showing the drive motor and weights.

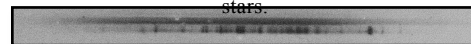
## Work done with the Astrographic

The initial Cape *Carte du Ciel* programme was completed in 1896 and was repeated 20 years later. About 500,000 stars were measured in the first round and some 40,000 stars had their proper motions determined from the repeat. These immensely labour-intensive programmes have been superseded in recent years by astrometric satellites such as Hipparcos and Gaia but the long baselines in time provided by the *Carte du Ciel* have been of value to modern work.

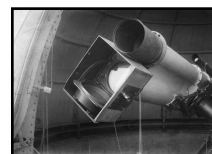
The telescope has in addition been used for many other purposes:



In 1897 Frank McClean (*left*), the donor of the McClean telescope and an avid amateur astronomer, placed an objective prism in front of the Astrographic telescope and took spectra of southern stars brighter than 3.5 mag. He discovered the existence of oxygen in stars.



Above: A spectrum of the emission-line star *Eta Carinae*, taken in 1897 by McClean.



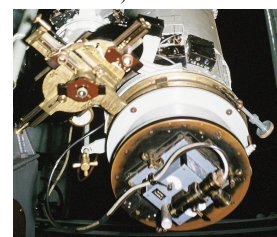
Left: McClean's objective prism mounted in front of the Astrographic Telescope.



JGEG Voûte (*left*), a Dutch volunteer who worked at the Cape during WWI, used the telescope for pioneering photographic parallax studies. He obtained a fairly accurate distance for Proxima Centauri, but could not confirm it to be the nearest star. He pointed

out that it was the least luminous star then known. (Proxima had originally been found due to its high motion with respect to other stars by RTA Innes in Johannesburg in 1915 but he had lacked proper means for measuring its distance. His statement that it was the nearest star was based on very weak evidence. Though he was actually right, real proof did not appear until decades later.)

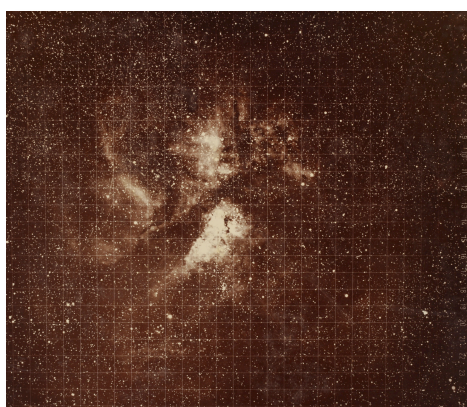
Right: From 1943 to 1980 the telescope was used for photometry. GR Roberts took this photograph of a photometer around 1961/62.



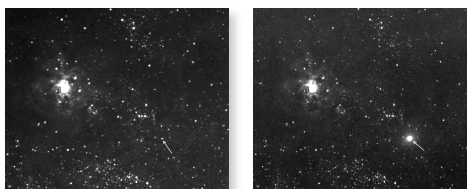
The Astrographic Telescope has been used to carry other instruments over its life. One was the "Old Astrometric Camera", used to produce the *Cape Photographic Catalogue for 1950.0*. This gave comprehensive data for 68,000 stars south of  $-30^\circ$ .

Another telescope, the photoheliograph, was mounted beside the Astrographic tubes during the period 1910-1929, after which it was moved to its present location in the oldest dome. [ISG]

## Examples of the telescope's work



Above: Photograph of the Carina Nebula taken March 26-30 1892 with an exposure time of 12 hours 12 minutes. The photograph incorporates a *reseau* of fine lines that was initially believed to increase the accuracy with which star positions could be measured but was later abandoned.



Above: Images of 30 Doradus ("The Tarantula Nebula") before and after the explosion of Supernova 1987A (arrowed).