Upgrading the 1.9-m Kottamia Telescope

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1 Introduction

1.1 The Kottamia Telescope

In spite of the favourable climate for astronomical observations, modern astronomy in Egypt only developed in this century. In 1905, Mr. Reynolds (an English amateur astronomer at that time, and later Treasurer of the Royal Astronomical Society in London) presented a 30-inch reflector to Helwan Observatory. This placed in the hands of Egyptian astronomers an instrument capable of making significant contributions to the science. Due to the clear sky of Helwan, Egyptian astronomers were able to collect a great number of photographic plates of nebulae, galaxies, comets (especially comet Halley in 1910), satellites of Jupiter, Pluto, the moon, and stars. The observations with the 30-inch continued for nearly half a century.

In the 1940s it was decided that a larger telescope was necessary and in 1948 the Egyptian Government placed an order with the British firm Grubb-Parsons for a new 74-inch telescope equipped with both Cassegrain and Coudé spectrographs. The telescope and spectrographs were expected in 1955. However, owing to numerous difficulties, delivery was delayed until 1960. First light was achieved in May 1964.

The telescope is equipped with three focal stations:

- a *Newtonian* focus equipped with a camera (f/4.9) for direct imaging.
- a *Cassegrain* focus equipped with a prism spectrograph (f/18) provided with two cameras giving dispersions of 48 Å/mm and 100 Å/mm at Hγ. Later, a multi-colour photoelectric photometer was designed to be installed at this focus for photoelectric observations.
- a *Coudé* focus equipped with a grating spectrograph (f/28.9) provided with two gratings giving dispersions 5.6 Å/mm and 20 Å/mm.

1.2 The Site

The Kottamia Observing station is located in the desert about 70 km northeast of Helwan, and is far away from disturbing influences such as city lights. With 200 clear nights a year, this site provides favourable conditions for astronomical observations.

The position of the telescope is:

Latitude	29 55′ 35.24″ N
Longitude	31 49′ 45.85″ E
Altitude	482.7 m

As far as the prevalent seeing conditions at the site are concerned, it is worth noting that on useable nights:

- 50% of seeing is in the range 1.5-2.0 arc sec. (in autumn and winter, being best in winter)
- 30% of seeing is in the range 2.0-3.0 arc sec. (in spring and summer, being better in spring)
- The remaining 20% of seeing is worse, ranging up to 5 arc sec at times.

1.3 Observational Programmes

A variety of observational programmes is conducted using this telescope. For example:

- Observations of the Moon and planets (in collaboration with American astronomers, NASA and Manchester University).
- Determinations of radial velocities (in collaboration with Greenwich Observatory).
- Photometry of star clusters in relation to Galactic Structure (in collaboration with Basel

Astronomical Institute, Asiago Astrophysical Observatory, Padua University Observatory and similar institutions in the UK, Germany and former Soviet Union).

2 Upgrading the Kottamia Telescope

In order to maintain Egypt's position in the international astronomical community it was considered desirable to make use of recent developments in mirror-making technology to modernize the approximately 35-year old 1.88-metre Kottamia telescope. Supported by one of the major resolutions of the *Fourth United Nations/European Space Agency Workshop on Basic Space Science,* which was hosted by the Government of Egypt in 1994, the question of modernizing the telescope was raised with the Egyptian Government. After extensive discussions between NRIAG and the Egyptian Government this project was approved and funded. The modernization of this telescope is especially important in view of the fact that it is the largest telescope in North and Central Africa, as well as in the Middle East. The importance of modernizing this facility, which would supply major experimental capabilities for basic space science in the region, is enormous.

2.1 The Optical system

The contract to refurbish the Kottamia telescope was awarded to the German company *Zeiss* in 1995. This involves equipping the telescope with new primary (M1) and secondary (M2) mirrors made of *Zerodur* glass ceramics. The new optics have already successfully passed acceptance tests at the Schott Glassworks in Mainz. To improve the optical performance of the system, a more efficient supporting system was developed for the primary mirror.
The final test of the combined optical system (M1+Cell+M2) show that the encircled energy E is:

- E 80% M1 (on optical penuche) 0.247 arc sec;
- E 80% M1 (in the Cell) 0.279 arc sec;
- E 80% M2 (in the Cell) < 0.26 arc sec;
- E 80% (M1+Cell+M2) $\leq$ 0.35 arc sec;

The on-site installation of the new optics is in progress. First light was expected sometime around November–December 1997. The first-light results will be reported in a future issue of *African Skies/Cieux Africains.*

Sommaire

Dès le début du siècle, grâce au ciel clair de Helwan, les astronomes Egyptiens participèrent activement à collecter un grand nombre de plaques photographiques de nébuleuses, galaxies, comètes (en particulier de la comète de Halley en 1910) à l'aide d'un réflecteur de 76 cm. Dans les années 1940, il fut décidé l'acquisition d'un télescope de 1,90 m, équipé de spectrographes Cassegrain et Coudé. De nombreuses difficultés firent que la première lumière ne fut obtenue qu'en Mai 1964.
Le télescope a trois équipements focaux: - une caméra (f/4.9) pour l'imagerie directe au foyer Newton , - un spectrographe à prisme avec deux dispersions 48 Å/mm et 100 Å/mm à Hγ, et un photomètre photoélectrique au foyer Cassegrain, - un spectrographe à réseau de dispersion 5,6 Å/mm et 20 Å/mm au foyer Coudé .

La station d'observation de Kottamia est située dans le désert à environ 70 km au nord-est de Helwan. On compte 200 nuits claires par an, avec 50% du "seeing" de 1,5 à 2,0 secondes d'arc en automne et hiver.

Les programmes d'observation concernent:
- l'observation de la Lune et des planètes en collaboration avec la NASA et l'Université de Manchester,
- la détermination de vitesses radiales en collaboration avec l'Observatoire de Greenwich,
- la photométrie de nuages stellaires en relation avec la structure de la Galaxie, en collaboration avec l'Institut de Bâle, les Observatoires d'Asiago et de Padoue et d'autres instituts au Royaume Uni, en Allemagne et dans l'ex-Union Soviétique.

Le télescope de Kottamia est le plus grand télescope en Afrique du Nord et en Afrique Centrale, ainsi qu'au Moyen-Orient. Sa revalorisation par des miroirs bénéficiant des technologies modernes a reçu l'appui des Nations Unies en 1994 et a été finalement approuvée par le Gouvernement Egyptien et financée. Le télescope sera équipé de nouveaux miroirs primaire et secondaire en verre Zerodur. L'installation sur le site du nouvel équipement est en cours.