A PROJECT OF A 40" TELESCOPE APPLIED TO A HIGH DISPERSION SPECTROGRAPH

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A project has been designed for the construction of a 40" telescope with distorsion free aplanatic optics. Its parameters are given in table 1 at the end of this article.

The purpose of this telescope is to prove the quality of its optics to perform high dispersion spectroscopy and photoelectric photometry.

It is an error to believe that in the Southern Hemisphere only telescopes of gigantic dimensions (100" or 200") are necessary; there is a great amount of work here to be done with smaller instruments so that the larger ones can be used for those programs where they are irreplaceable. It is easy to show that for very high dispersions the diameter of the primary mirror is not a factor of first importance (1). With the DIMP (Platzeck's Multiple Images Device) and electronical techniques a much greater factor can be achieved than with the diameter of the primary mirror.

On the other hand, it is wasteful to do high dispersion spectroscopy with large telescopes whose cost and upkeep is expensive, as the exposure time in this kind of work is naturally very long. The first object of the projected telescope is to do high dispersion spectroscopy; applying the DIMP without additional electronic techniques it is possible to reach magnitude 6 as a limit in one night. With electronic techniques it is not difficult to obtain a high enough factor to reach magnitude 9 or 10. The object of high dispersion spectroscopy will be directed specially towards the study of stellar atmospheres.

Table 2 contains the data of the coudé spectrograph. Camera II in the enclosed plan is only a possibility that could be developed in the future if it were advisable.

The horizontal type mounting has setting system by means of signal repeaters, a rough guiding system with a variable differential sincronisation and a fine guiding with a photocell which guides a small carrier holding either the plate or the photometer head and which moves differentially with respect to the telescope. The guiding with the cell is done with stars situated in a circular ring of 20' of arc surrounding the telescope field. As the optics are aplanatic there is no difficulty with this type of guiding.

The figures give a schematic view of the project.

In this project the visibility and quality of the images, the telescope site is of the utmost importance because in an excepcionally favourable position the type of optics exposed here will show all its advantages.

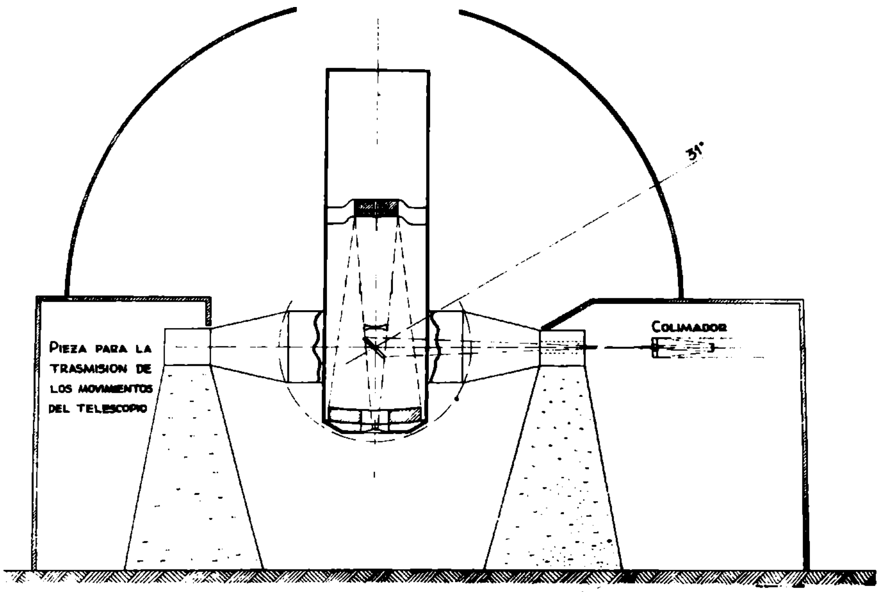


Table 1

D_1 = 1 m (diameter of primary mirror)

F = 5,2 (total focal ratio of the system)

ξ = 2,0000 = f_2/f_1

q_o = 0,48290 = D_2/D_1 (obstruction of the primary taking into account the field)

f_1 = 4,0103 m (focal of primary)

f_2 = 8,0205 m (focal lenght of secundary)

d = 2,1752 (distance between primary and secondary)

sagitta = 0,000247 m (maximum distance of curved plate respect to the tangent plane)

$R(D_1)$ = -1,8517 m (radius of curvature of mean focal surface)

A = + 2,0035 (figuring depth of primary expressed in terms of parabolic correctión)

B = - 1,3320 (figuring depth of secondary expressed in terms of parabolic correction)

θ = 37',1 (diameter of the field of the system,in which the stellar image is kept $\lesssim$ 1"

Observe that the field is nearly plane as the maximum distance of the plate from the tangent plane is 0,000247 m (few decimals of a milimeter).

Table 2

The Coudé Spectrograph

This spectrograph is designed with two large distance cameras, but we think it convenient to make camera I first, the optics of which is practically finished,in order to get experience in the electronic technique etc. The camera II is shown only as a possibility to be carried out later on if justified by the experience acquired when building camera I.

Camera I

Mirror diameters 0,92 m

focal lenght: 2,09 m

Spherical mirror type Schmidt system without correcting lens; the figuring of the lens is introduced in the principal mirror of the collimator (Cassegrain type).

Grating I : Bausch & Lomb of 600 grooves/mm with a blaze in 3000 Å; 203 x 254 mm or larger.

Grating II: Bausch & Lomb of 600 grooves/mm with a blaze in 8000 Å; 203 x 254 mm or larger (if available at the time of the construction of the telescope).

Dispersions - 7,8 Å/mm (Grating I; 1st order) Spectral region 2900 - 5600

- 7,8 Å/mm (Grating II; 1st order) Spectral region 5600 - 8300

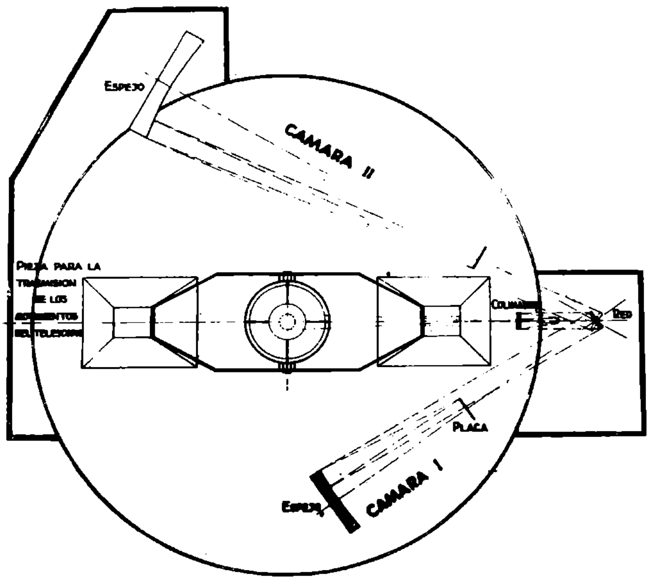
The plate covers an interval of 2591 Å

- 3,9 Å/mm (Grating II; 2nd order) Spectral region 2900 - 6945

The plate covers an interval of 1345 Å

The slit opens on the focal plane of the telescope h" = 2"27 with the DDMP;for a slit width on the plate of 20 microns; it can be seen that using smaller slit (10 microns for example) the slit on the focal plane of the telescope is still larger than 1".

The high of the spectra on the plate is 0,44 mm.



Camera II (Hypothetical)

With the same gratings and a focal distance of 7m50 it would give a dispersion of 2,2 Å/mm for the first grating and 1,1 Å/mm for the second order of the grating III; applying in this case also the IIMP the h" = 1"90.

Bibliography

(1) Ricardo J.Platzeck y J.Landi Dessy. Sobre el rendimiento de los espectrógrafos astronómicos. Boletin de la A.A.A: n° 7.

(2) J.Landi Dessy. Proyecto de un telescopio de 1 metro de diámetro acoplado a un espectrógrafo de alta dispersión.Boletin de la A.A.A. n° 7.