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Adjustment of a telescope

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ADJUSTMENT OF A TELESCOPE

A telescope is adjusted for parallel rays if the cross hairs are in the focal plane of the eyepiece and if the focal plane of the objective coincides with the focal plane of the eyepiece. Under these conditions an incident parallel bundle of rays will emerge from the eyepiece as a parallel bundle of rays.

PROCEDURE:

1. Scatter light through the telescope to illuminate the cross hairs. Move the eyepiece in the draw tube relative to the cross hairs until the best possible image is formed while your eye is focused for a distant object. The cross hairs are now in the focal plane of eyepiece. (To focus your eye for a distant object, alternately look at a distant object with one eye and at the cross hairs with the other).
2. Place a reflecting surface in front of the objective lens so that it is approximately perpendicular to the axis of the telescope. To do this place your eye a little to the left of the eyepiece and at the same height. Rotate the reflecting surface about a vertical or horizontal axis until you can see the image of your eye. The reflecting surface is now approximately perpendicular to the rays from your eye. Illuminate the cross hairs with the flash light lamp through the opening in the side of the GAUSS eyepiece. Place your eye a little further to the left to find the image of the cross hairs. Rotate the reflecting surface about the vertical axis and follow the image with your eye until you are observing through the eyepiece. A slight rotation of the reflecting surface should cause a blaze of reflected light to cross the field of view. Center this blaze of light in the eyepiece. Adjust the knurled ring on the telescope, which moves the eyepiece and cross hairs as a unit, until a second image of the cross hairs is visible in the reflected blaze of light. The focal plane of the objective lens coincides approximately with the focal plane of the eyepiece. To make this coincidence precise, eliminate the parallax between the cross hairs and the reflected image of the cross hairs by fine adjustment of the knurled ring. The telescope is now adjusted for parallel rays and the method used to adjust the telescope is called autocollimation.

Elementary Theory:

According to definition, the magnifying power or angular magnification is

$$M = \tan U' / \tan U \doteq U' / U$$

Evaluating the tangents in Figure 1 yields

$$M = \frac{y' / f_e}{y' / f_o} = f_o / f_e$$

(4616)

Considering the exit pupil as the image of the objective lens form by the eyepiece as a simple lens yields

$$\frac{D_o}{E} = \frac{S}{S'} = \frac{f_o + f_e}{f_e(f_o + f_e)/f_o} = f_o/f_e = \gamma$$

Note that all of the rays which enter through D_o emerge through E . Therefore, the pupil of the observers eye should be placed at E .

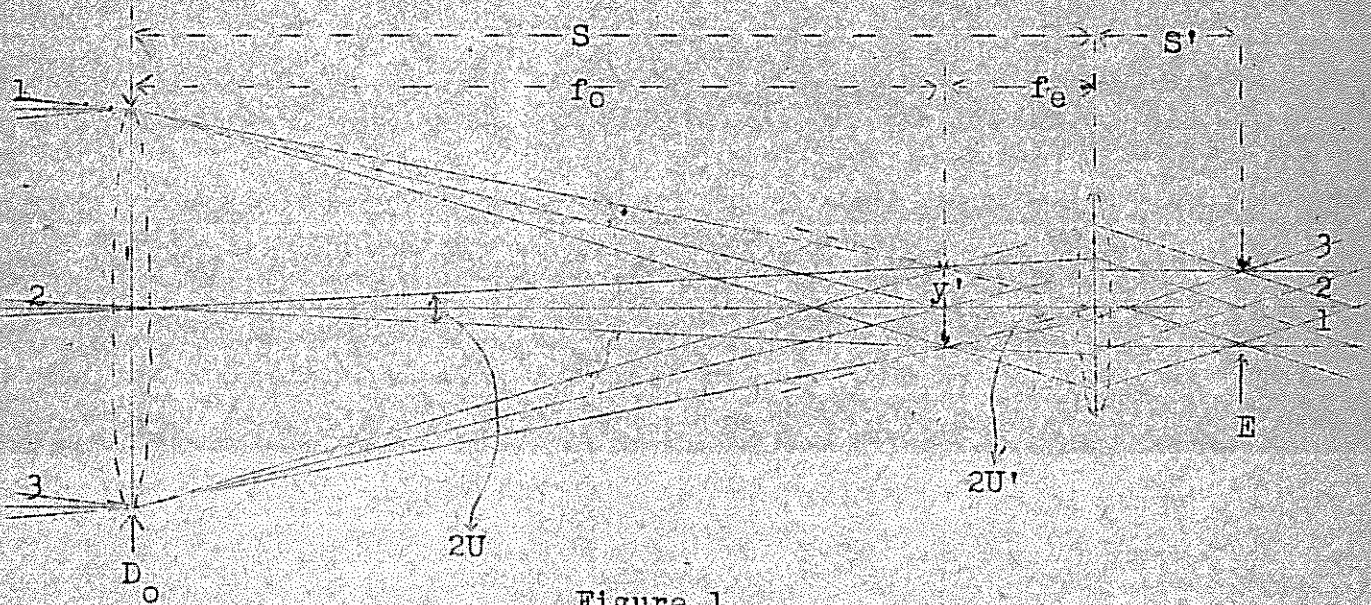


Figure 1.