D.F.

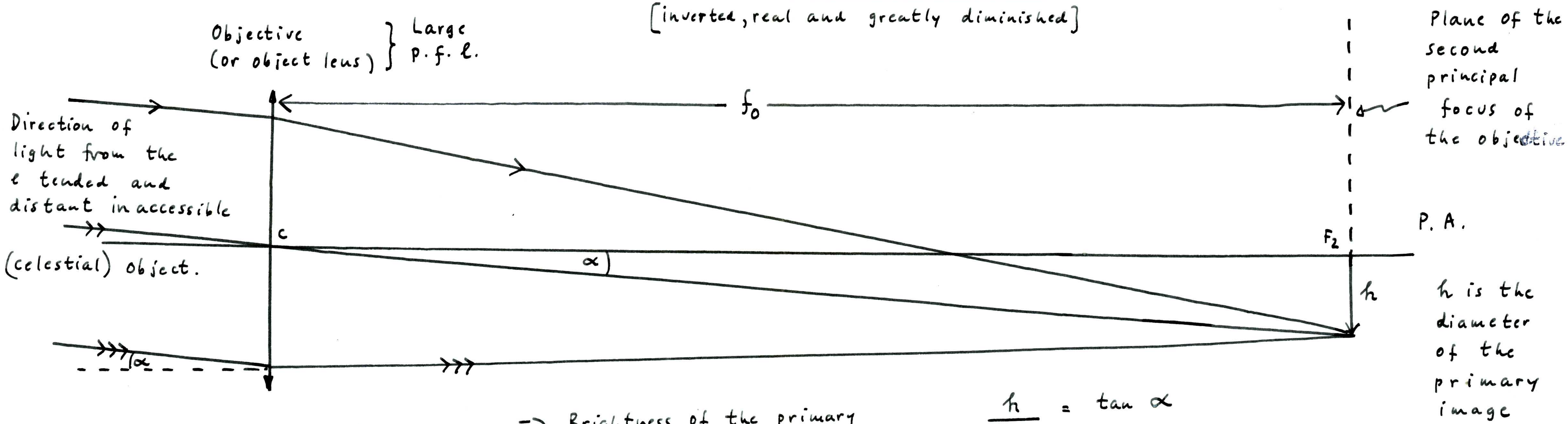
The Astronomical refracting telescope

The function of the instrument is to produce an enlarged retinal image of a distant inaccessible object.

I must stress the fact that the angles (normally) encountered in optical Astronomy are small: for example, the angle subtended by the Moon at the Earth is only 0·5°; a major planet might have an angular size of, perhaps, $\frac{1}{200}^{\circ} = 0{\cdot}005^{\circ}$ Clearly, angles must be exaggerated for the sake of clarity.

Formation of the primary image

[inverted, real and greatly diminished]



The angle subtended by the celestial body is determined by:

(i) The diameter of the body and

(ii) its distance from the Earth.

I am sure you realize that neither of these can change

=> a given celestial object subtends the same angle at the Earth, for all telescopes.

The light-gathering power of the objective increases by the square of the aperture.

=> Brightness of the primary image is proportional to the (aperture)^2

For "aperture" also read "diameter," d.

i.e., $B \propto d^2$ [fixed f_0]

A thicker lens would absorb more light and reduce the intensity of the primary image.

The objective is always a compound lens (cemented to a concave lens of different refractive index), to reduce chromatic aberration.

$$\frac{h}{f_0} = \tan\alpha$$

i.e., $h = f_0 \tan\alpha$

Now, α is constant

=> $\tan\alpha$ is constant

$\therefore$ $h \propto f_0$

The diameter of the primary image is directly proportional to the p.f.l. of the objective.

$\therefore$ A large f_0 is required, since α for a given body is unalterable.

For photographic work, the plate would be placed in the plane of the second principal focus.

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