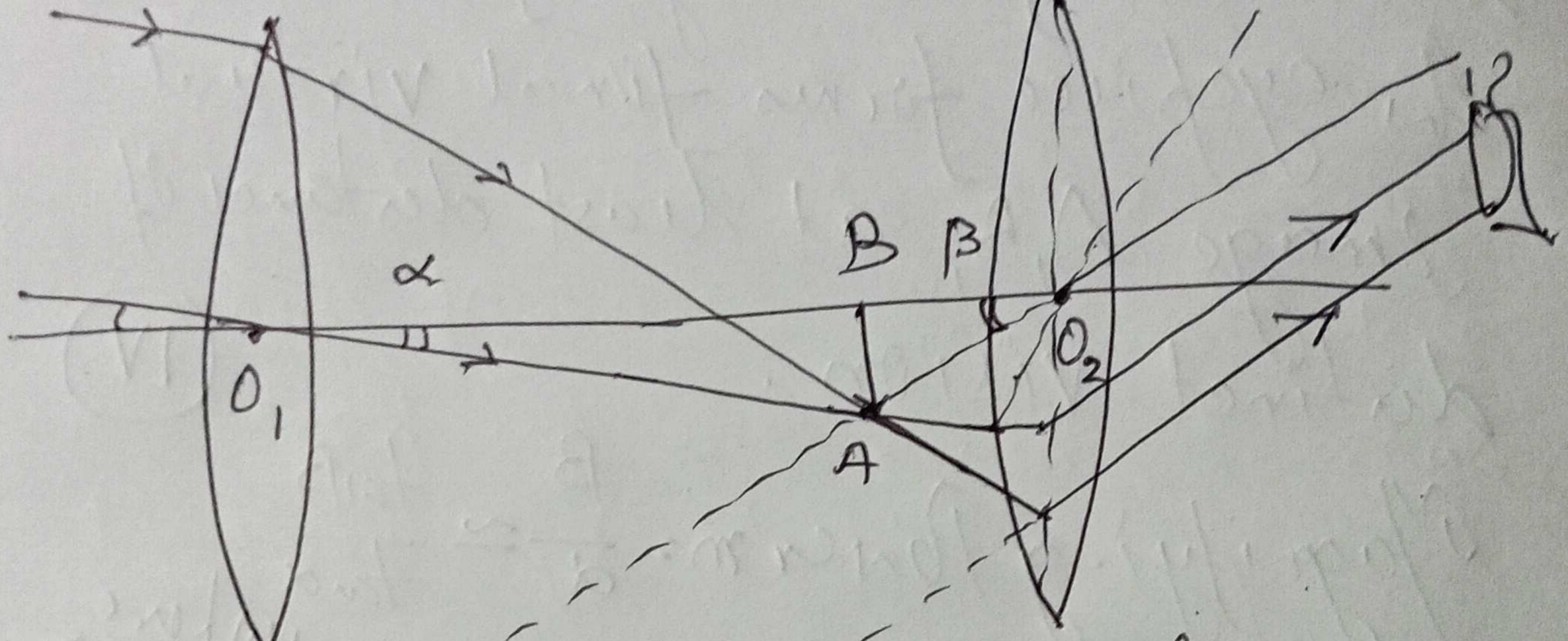
Astronomical Telescope:

This telescope is an optical device used for viewing far objects, celestial bodies like stars and planets. It consists of two coaxial Convex lens one kept near the object called Objective and other is near the eye is called eye-piece.

The focal length of objective is larger & aperture is wider. while focal length of eye-piece is small & aperture

This telescope is used in two different conditions.

① When final image of object is formed at Large (infinite) distance



Objective. Eye-piece.

The rays coming from far away objec
gets focussed on focus of Objective & forms
inverted real image AB.

$O_1B = f_o$ = focal Length of Objective

The position of eye-piece is adjusted
so that this image is at focus of Eyepiece

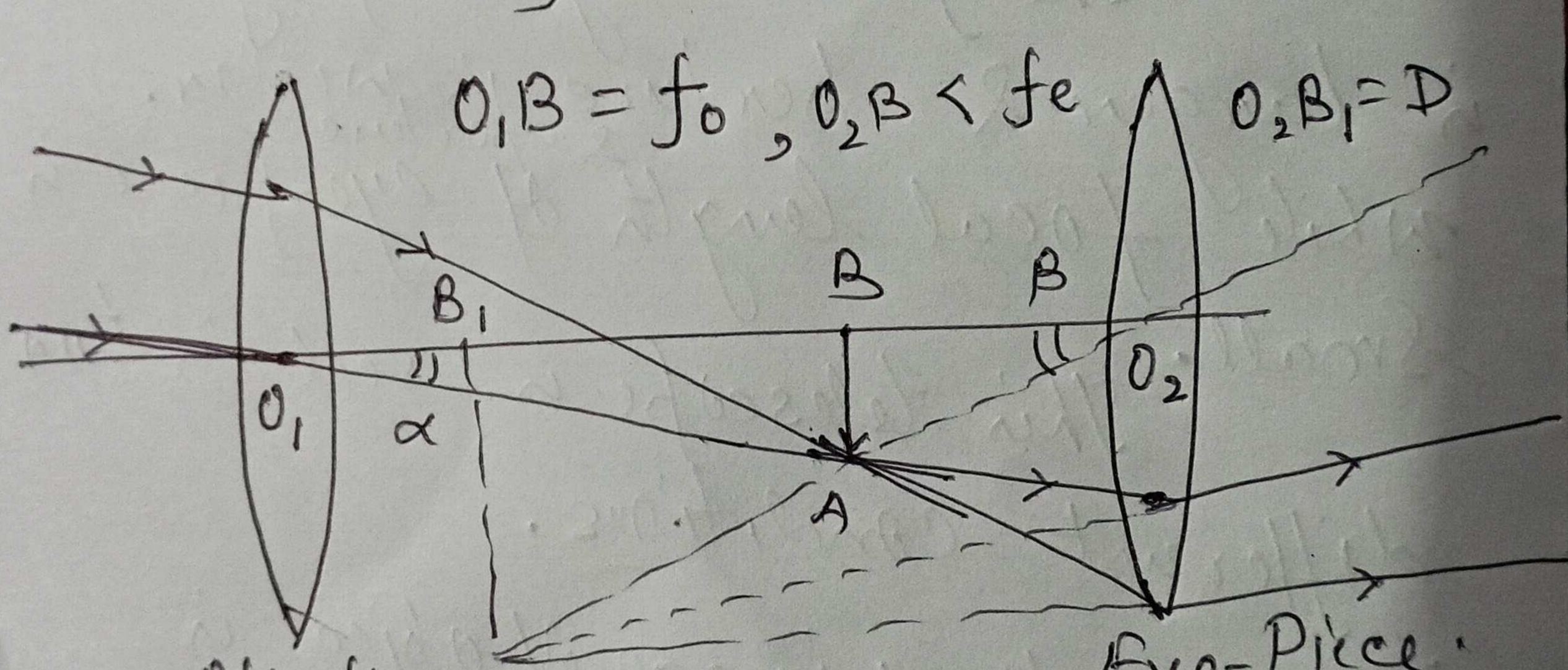
$O_2B = f_e$ = focal Length of Eye-piece.

The final image is formed at infinity.

Magnification of telescope in this mode $m = \frac{-\beta}{\alpha} = -\frac{\tan\beta}{\tan\alpha}$

$$= -\frac{AB/f_e}{AB/f_o} = \frac{f_o}{f_e}$$

(ii) When Astronomical telescope is used in the adjustment in which final image is formed at least distance of Distinct vision.



The Objective forms inverted real image AB at its own focus. The positio

of Eye-piece is adjusted so that AB lie within its focal length f_e so that the eyepiece forms final virtual image A_1B_1 at least distance of distinct vision.

(IV)

Magnifying Power $m = \frac{\beta}{\alpha} \simeq \frac{\tan\beta}{\tan\alpha}$

~~$m = m_0 \times m_e$~~ $= \frac{A_1B_1/O_2B_1}{AB/O_1B}$

$= \frac{A_1B_1}{AB} \times \frac{O_1B}{O_2B_1}$

~~$m_e \times$~~ $= m_{eyepiece} \times \frac{f_o}{D}$

$= \left(1 + \frac{D}{f_e}\right)\frac{f_o}{D}$

$= \frac{(f_e + D)f_o}{Df_e}$.

where $O_2B_1 = D$, $O_1B = f_o$

Applying Lens Makers formula on eyepiece.

$\frac{1}{v_e} - \frac{1}{u_e} = \frac{1}{f_e}$

$1 - \frac{v_e}{u_e} = \frac{v_e}{f_e}$

$m_e = -\frac{v_e}{u_e} = 1 - \frac{v_e}{f_e} = 1 + \frac{D}{f_e}$