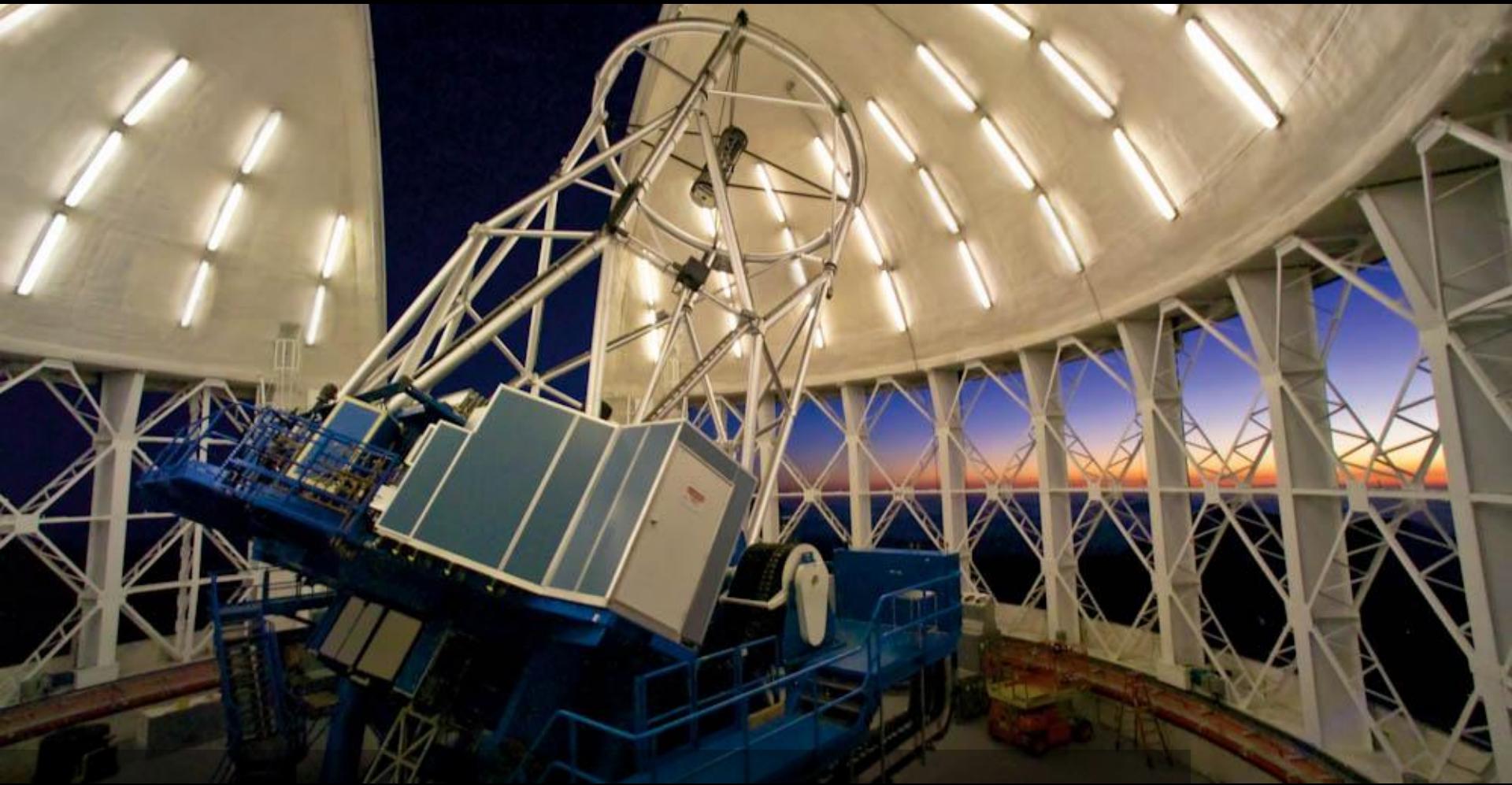


LARGE TELESCOPES – AND WHY WE NEED THEM

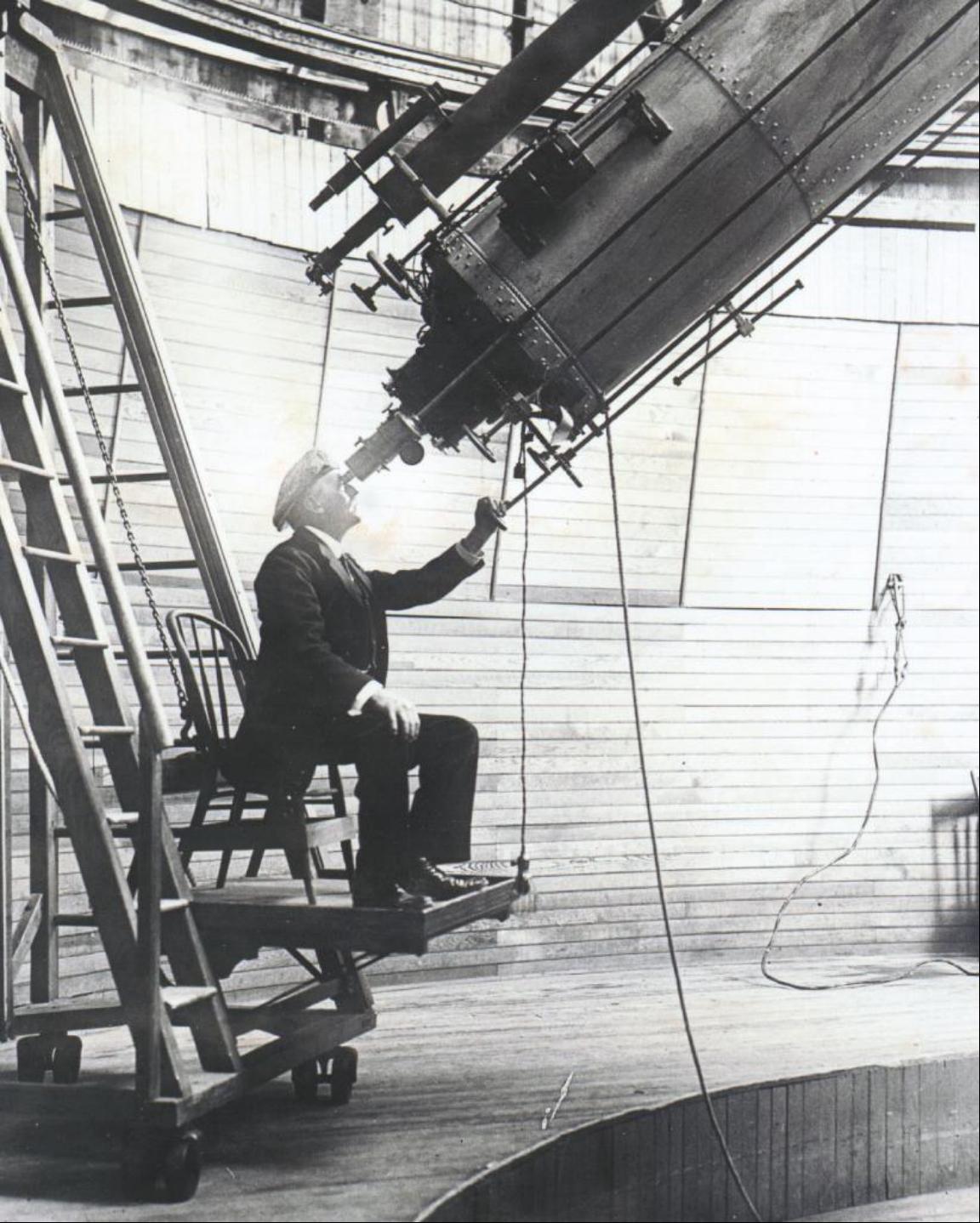


CAROLIN CRAWFORD
GRESHAM PROFESSOR IN ASTRONOMY

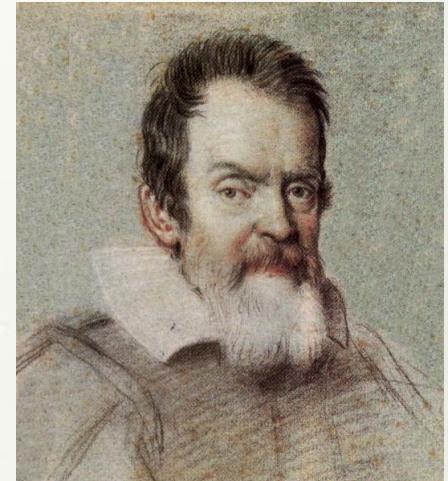
Gemini Observatory



Stephen Leshin

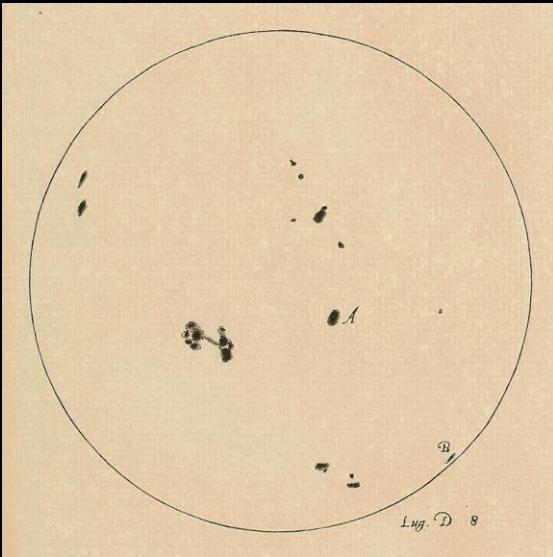
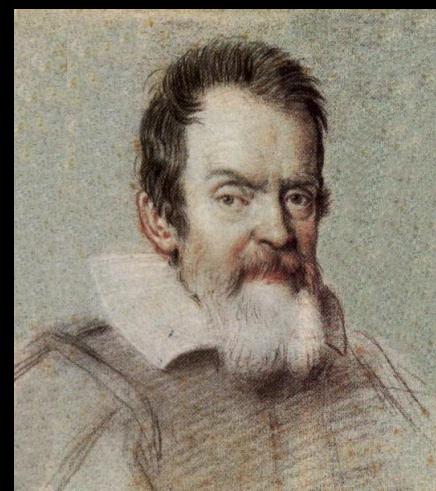
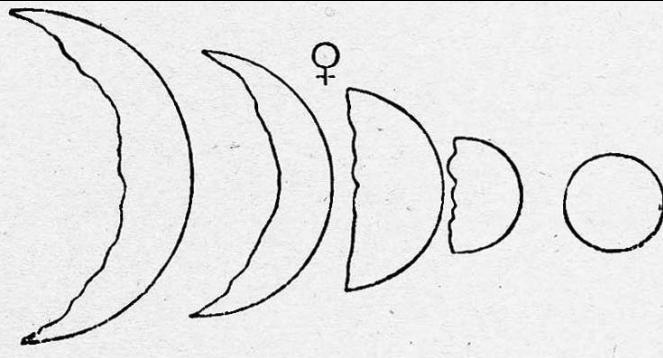
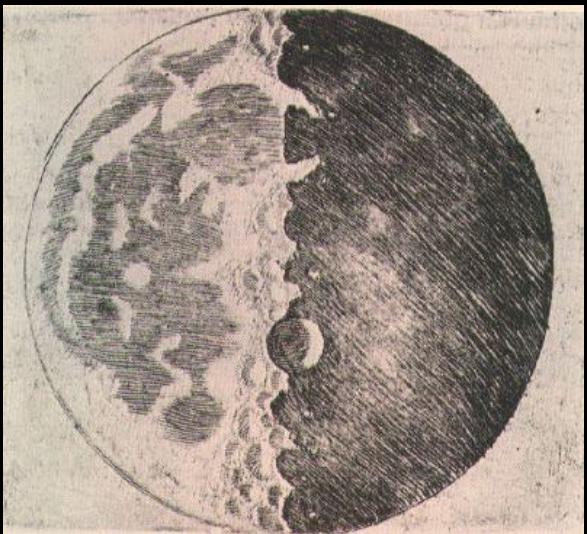


Lowell Observatory



Galileo
(1564-1642)



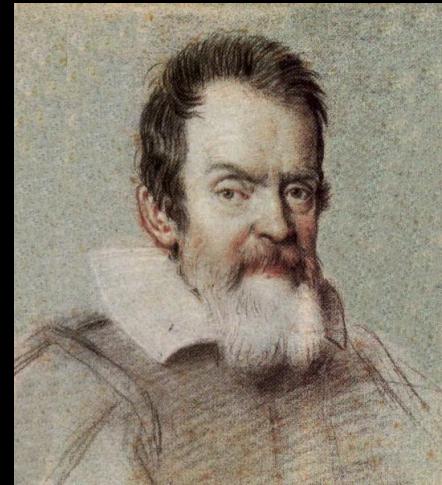


con due stelle à i fianchi , creda pur V. S.
fione delio strumento, ò dell'occhio del ri-
sido la figura di Saturno così ; come
fette visto i perfetti strumenti , dove non
apparisce così non si distinguendo
l'razione , e figura delle tre stelle ; ma io
versi tempi con eccellente strumento l'ho
sicurata , che in esso non si è scorta mut-

Observationes Ierulanae			
			1610
2. O. genij.		O ***	
marcelli. 12			
3. mons'	**	O *	*
2. genij.	O	***	*
3. mons'	O	* *	
3. Ho. s.	*	O	*
4. mons'	*	O	**
6. mons'	**	O	*
8. marcelli. 13.	***	O	
10. mons'	*	* * * O	*
11.	*	* O	*
12. H. 4. regi:	*	O	*
13. mons'	*	** O	*
14. danci.	*	* * O	*

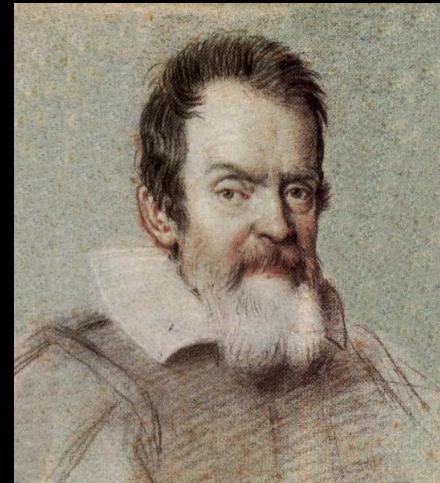


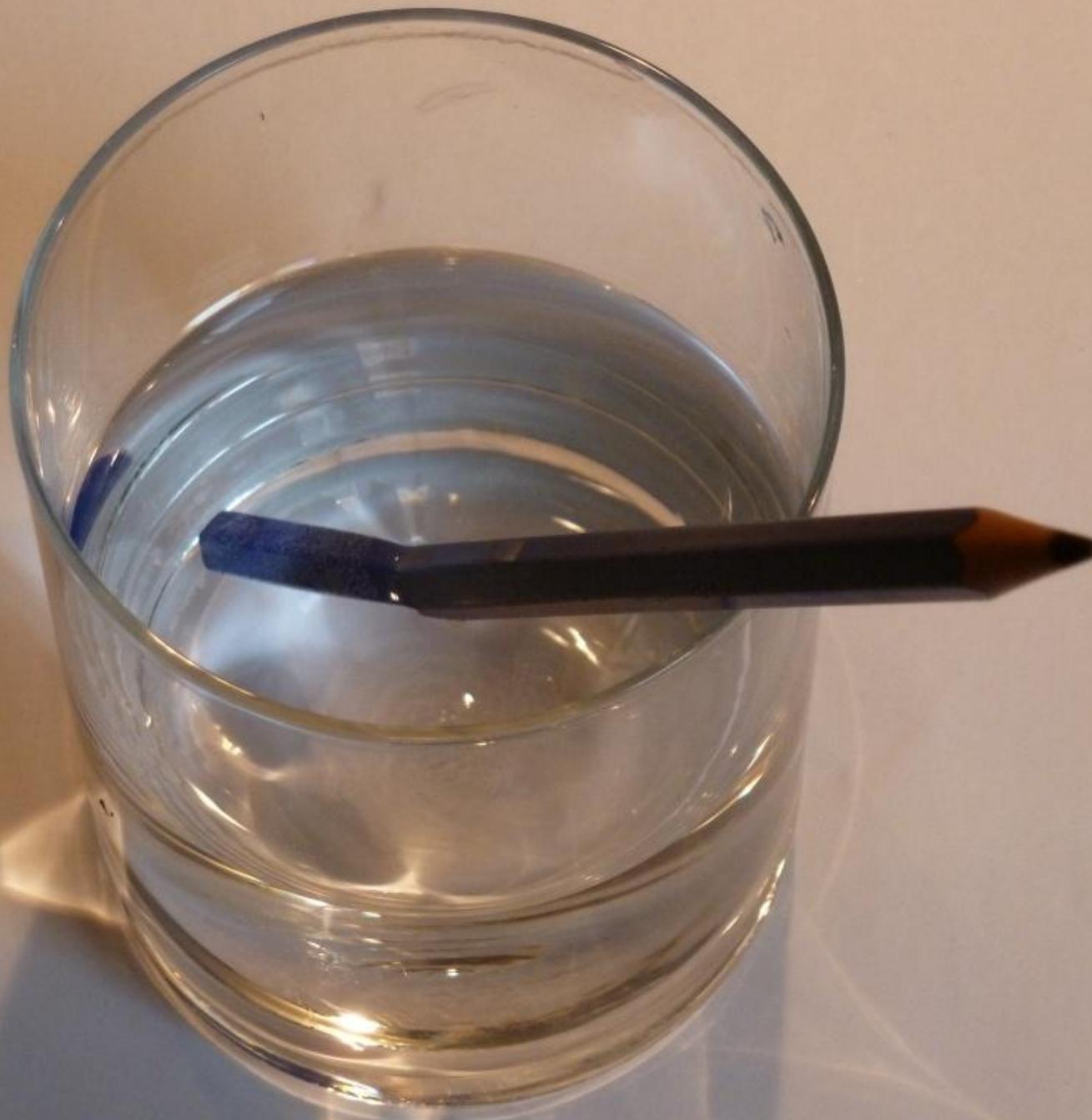
Kerry-Ann Lecky Hepburn

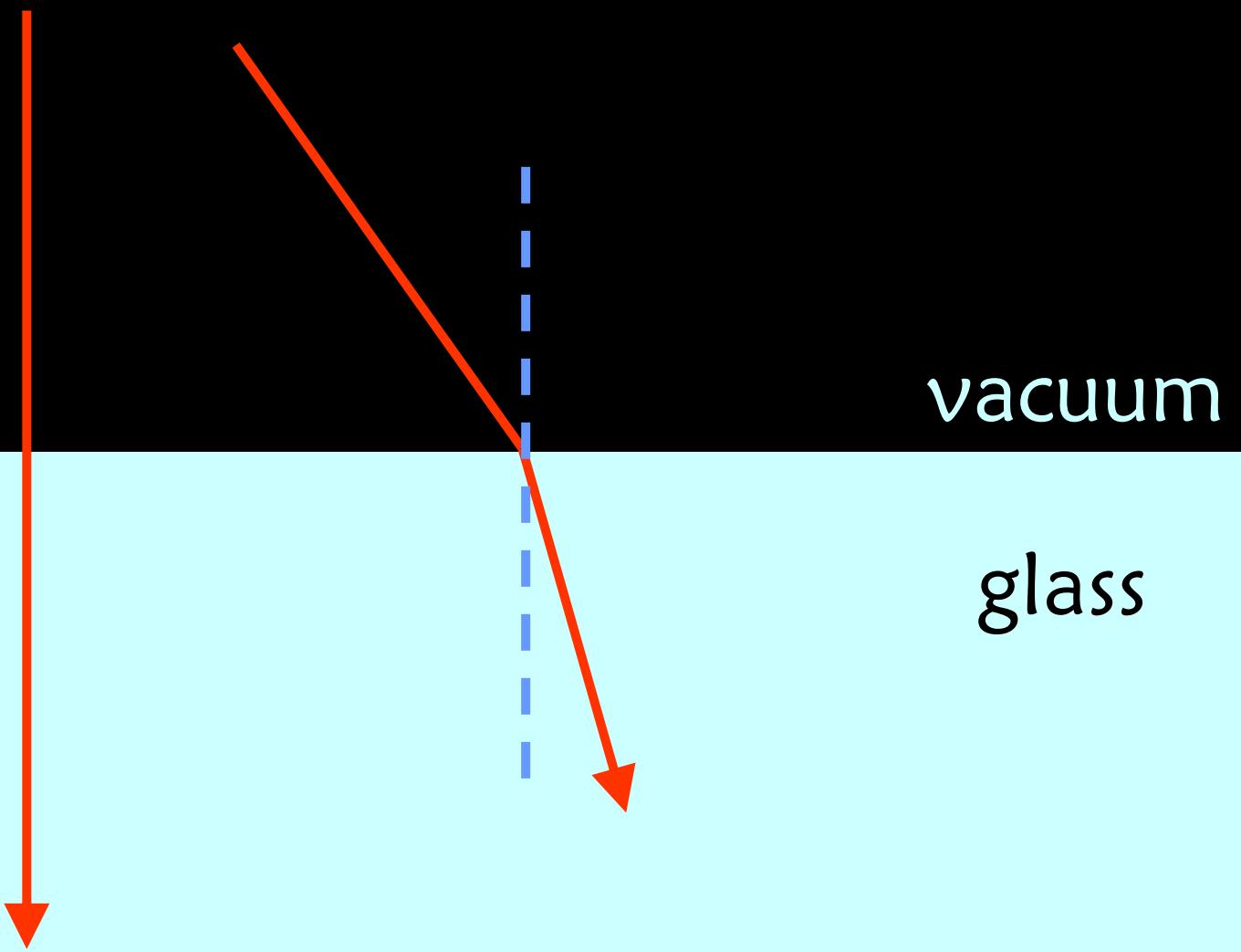


Robert Gendler

Cinguli et Ensis ORIONIS Asterismus.

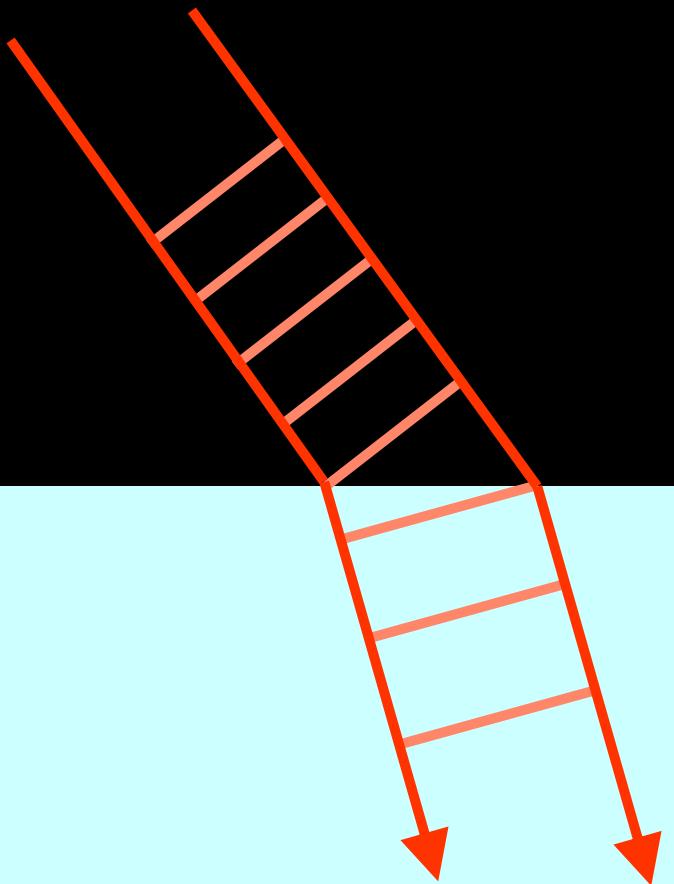


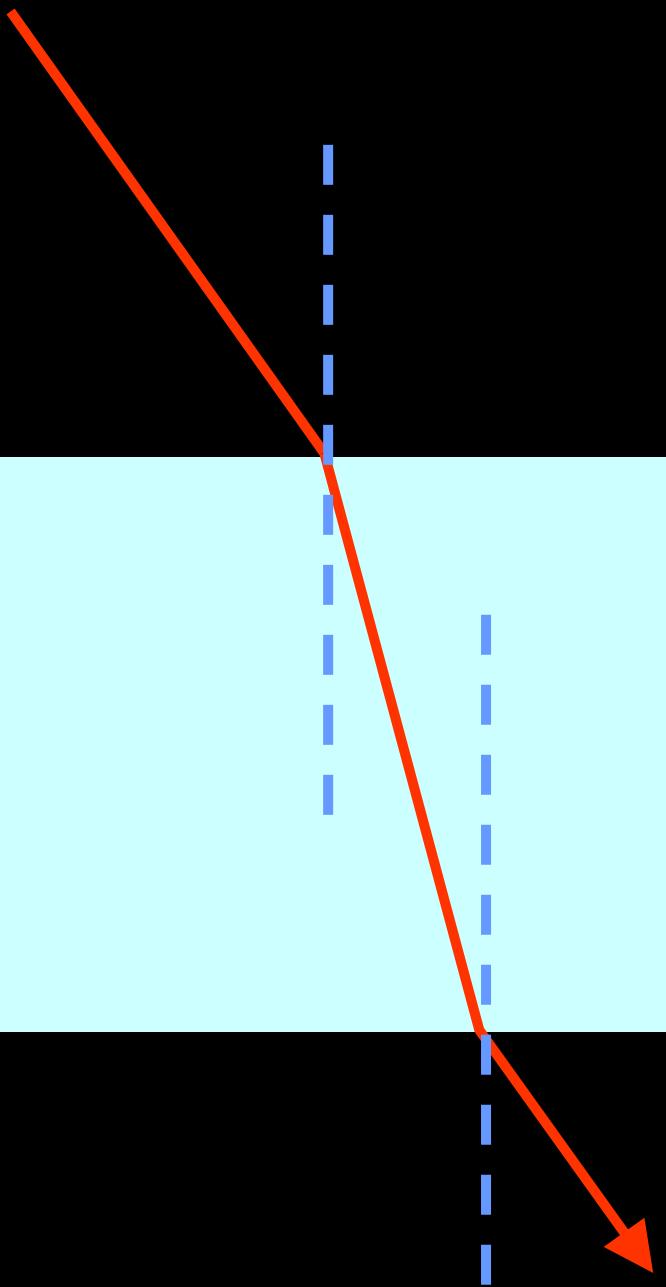


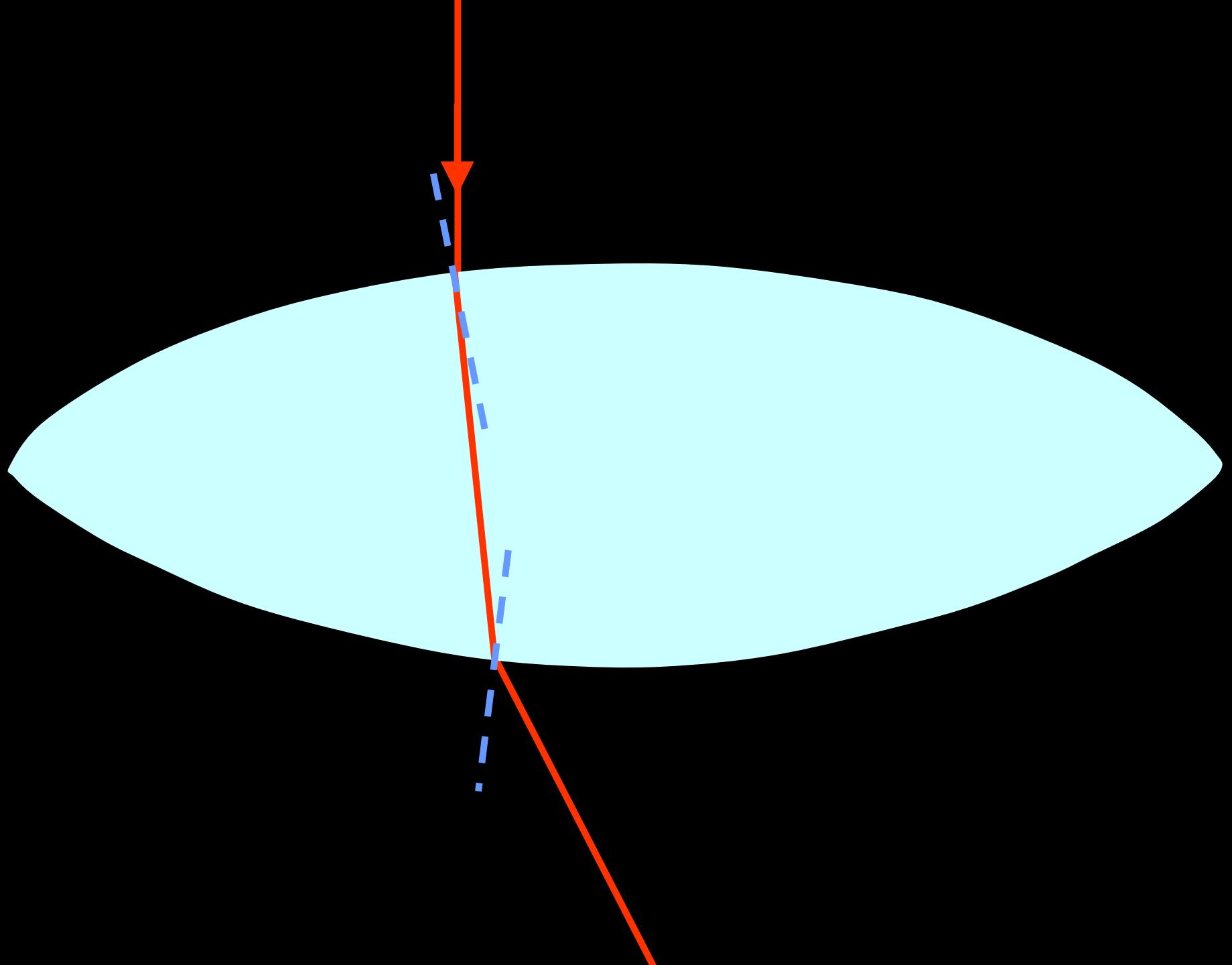


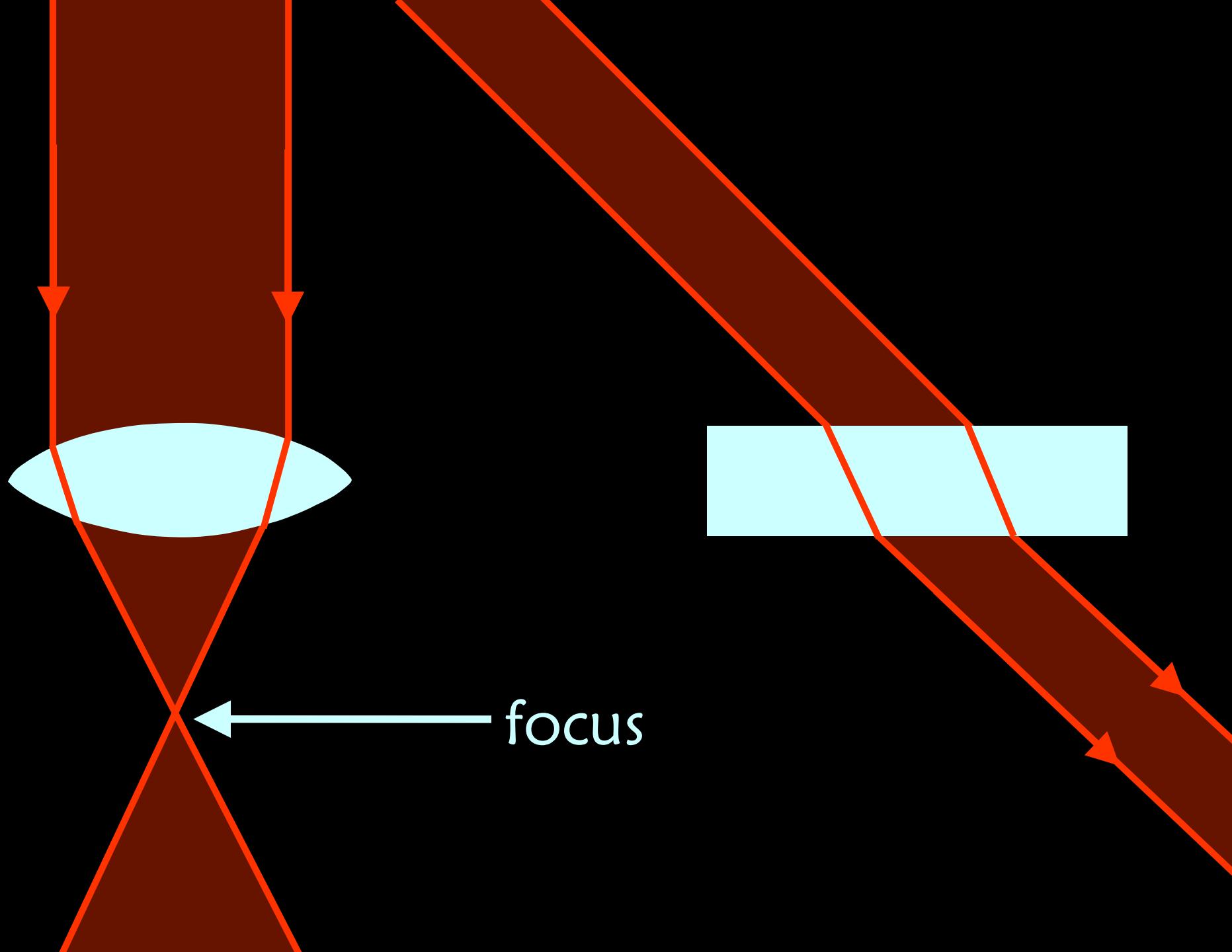
vacuum

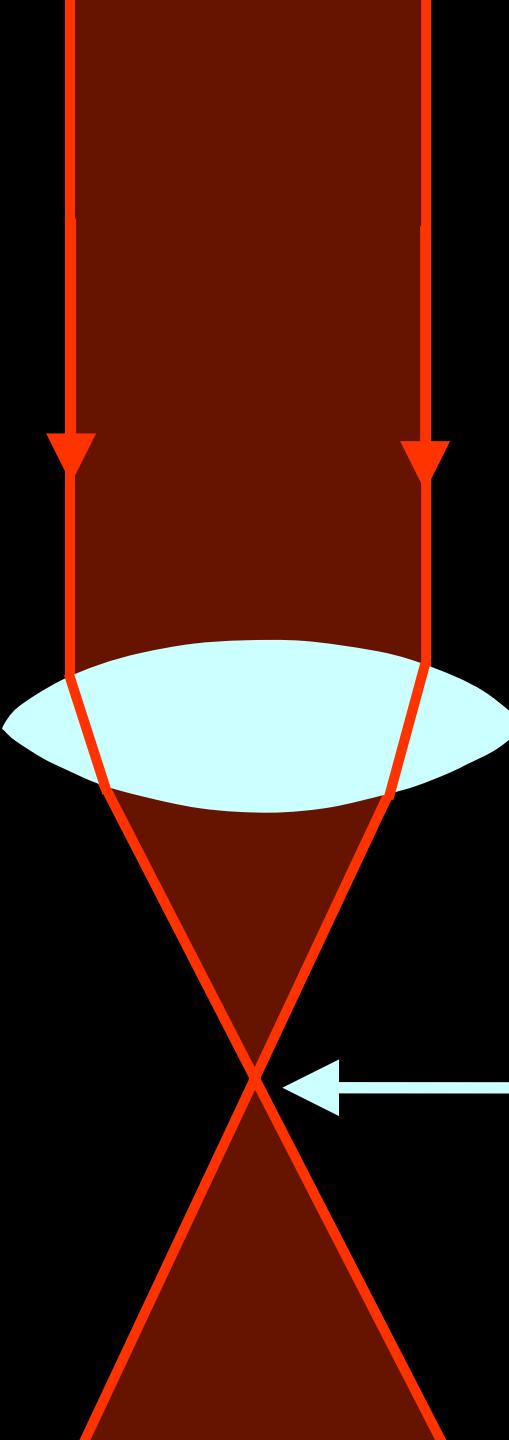
glass







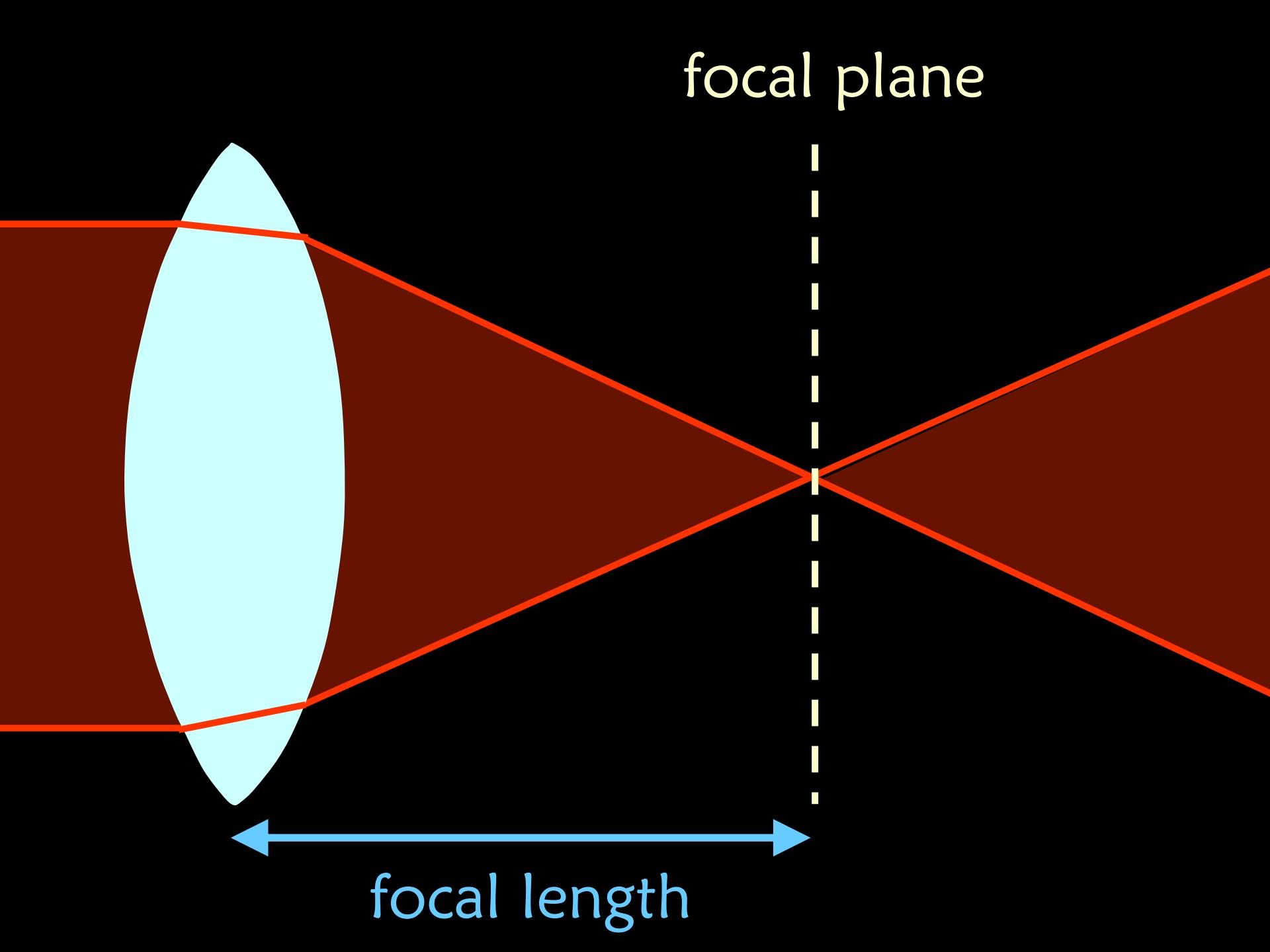




A diagram illustrating the formation of a real image by a converging lens. A blue lens is shown at the bottom, with light rays passing through it and diverging upwards. These diverging rays are represented by red lines that converge at a point on a vertical orange plane positioned above the lens. Two red arrows point downwards from this plane, indicating the real image is inverted. Below the lens, a horizontal blue arrow points to the left, labeled "focus". To the right of the lens, a blue double-headed vertical arrow is labeled "focal length", indicating the distance from the lens to the point where the light rays converge.

focal length

focus

A diagram illustrating the optical properties of a lens. A light blue lens shape is positioned on the left, with its front surface facing right. Two parallel orange lines represent light rays traveling from the left towards the lens. After passing through the lens, these rays diverge. A vertical dashed yellow line, labeled "focal plane" at the top, represents the plane where the diverging rays appear to originate. A horizontal double-headed blue arrow at the bottom is labeled "focal length".

focal plane

focal length

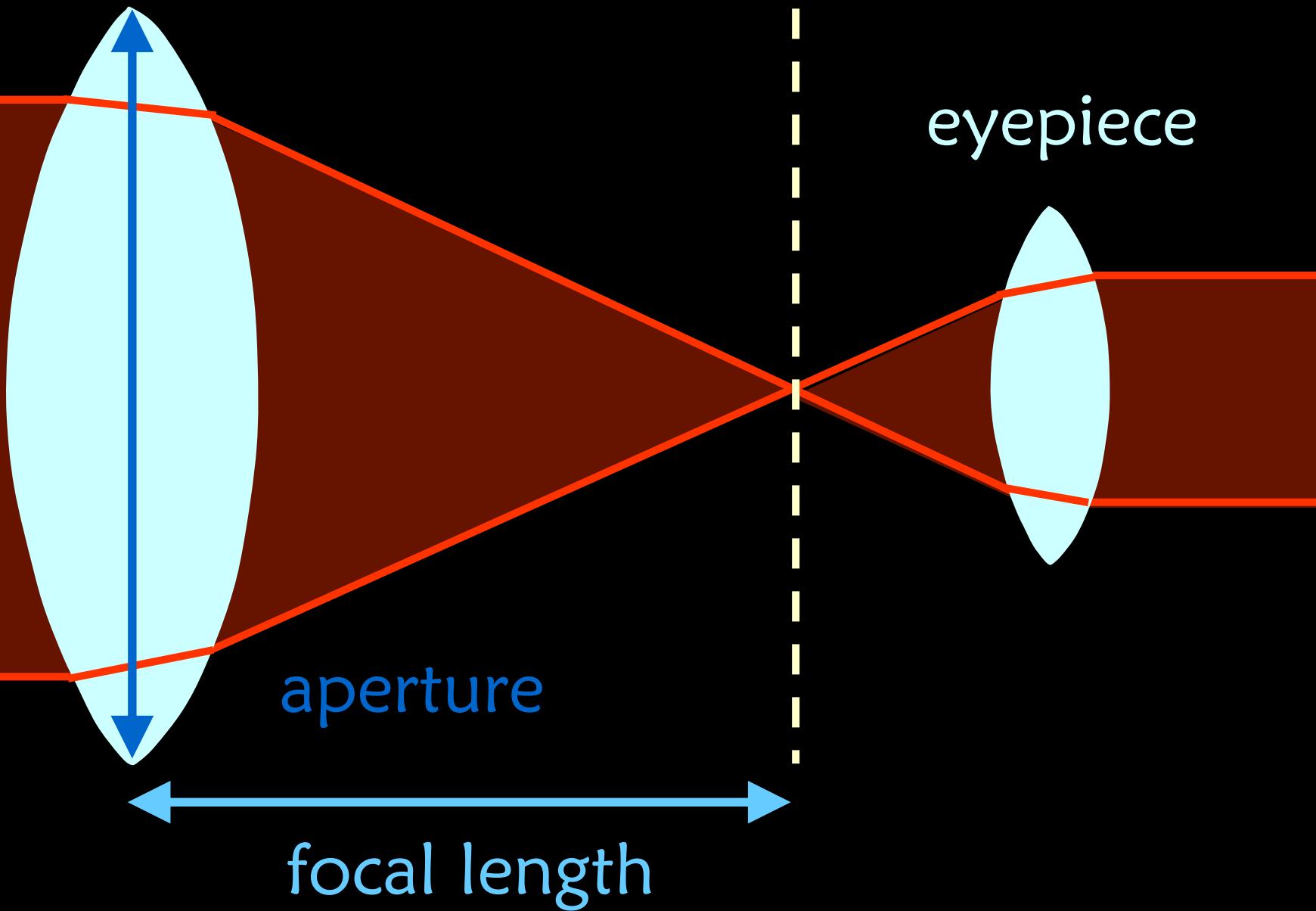
objective

focal plane

eyepiece

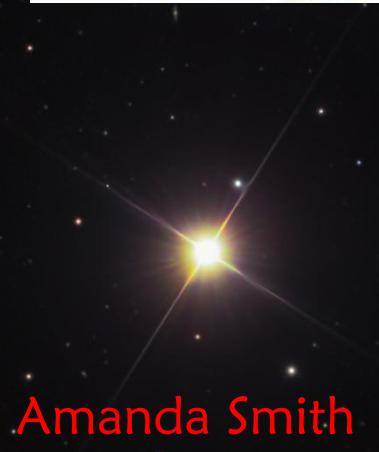
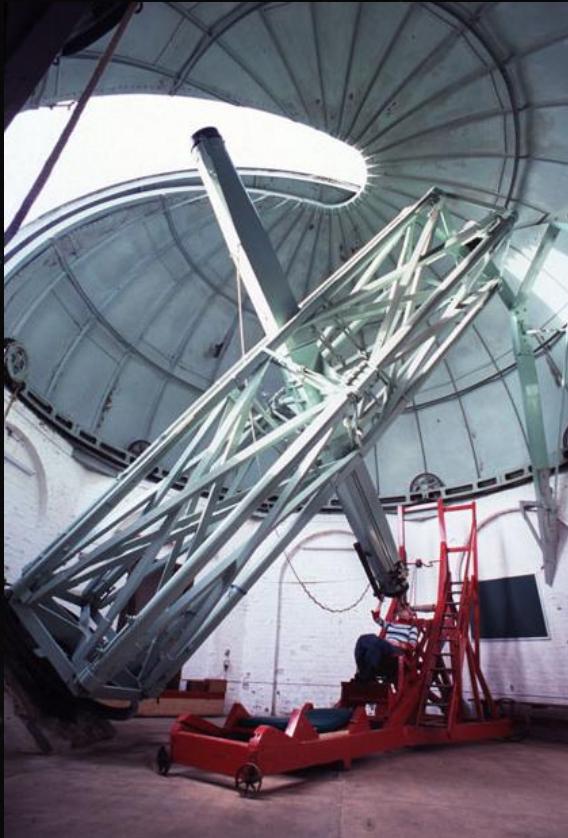
aperture

focal length

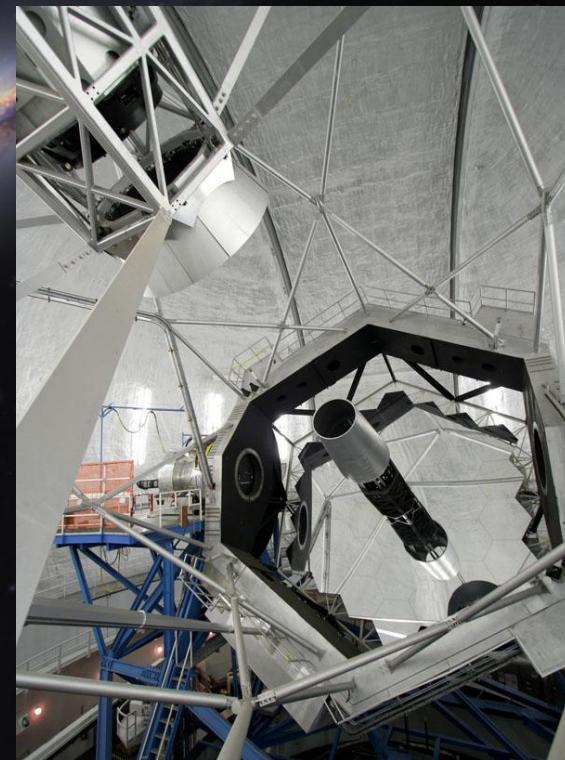


Light gathering power
depends on area

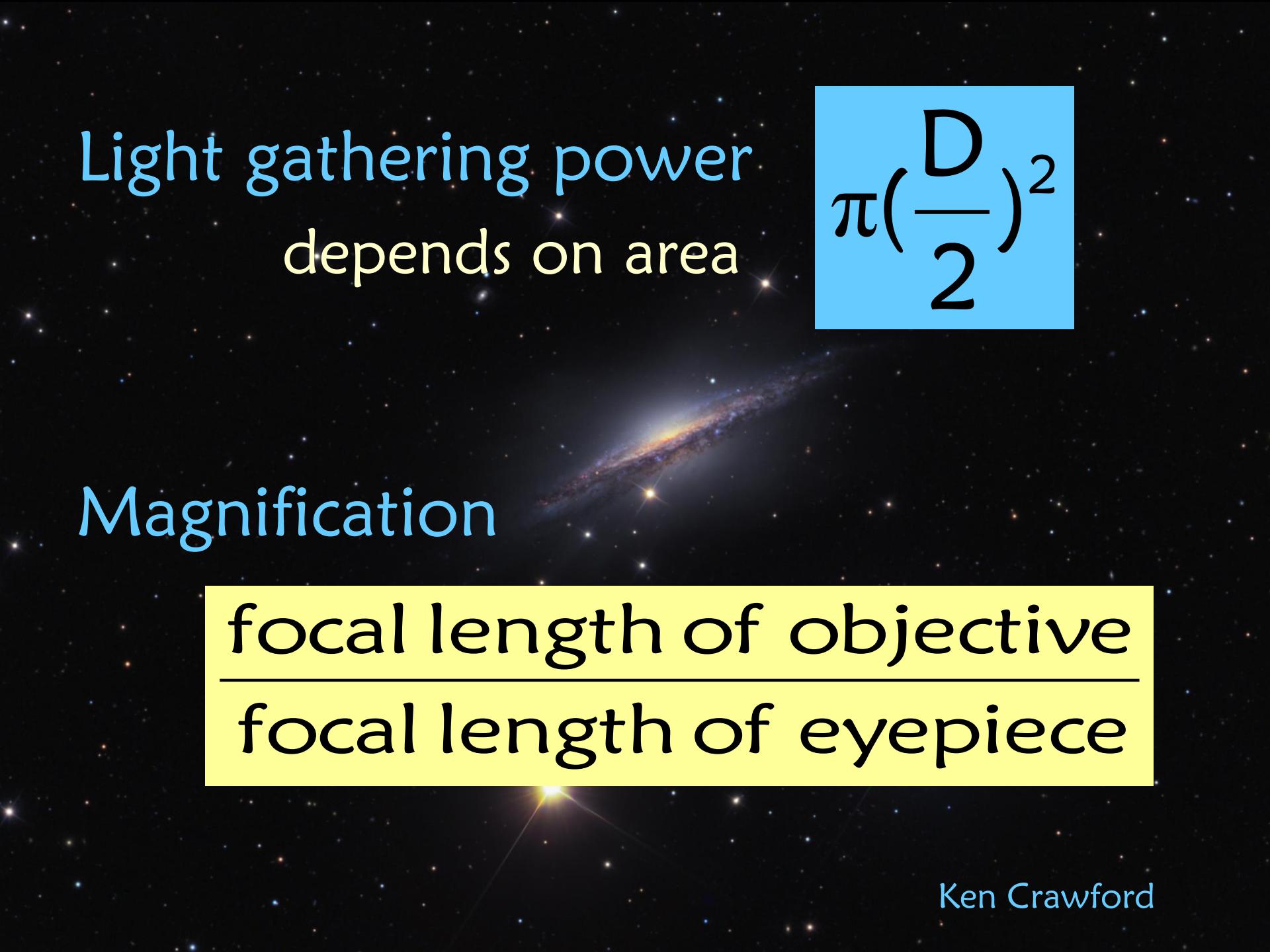
$$\pi \left(\frac{D}{2}\right)^2$$



Amanda Smith



Ken Crawford
Andrew Cooper

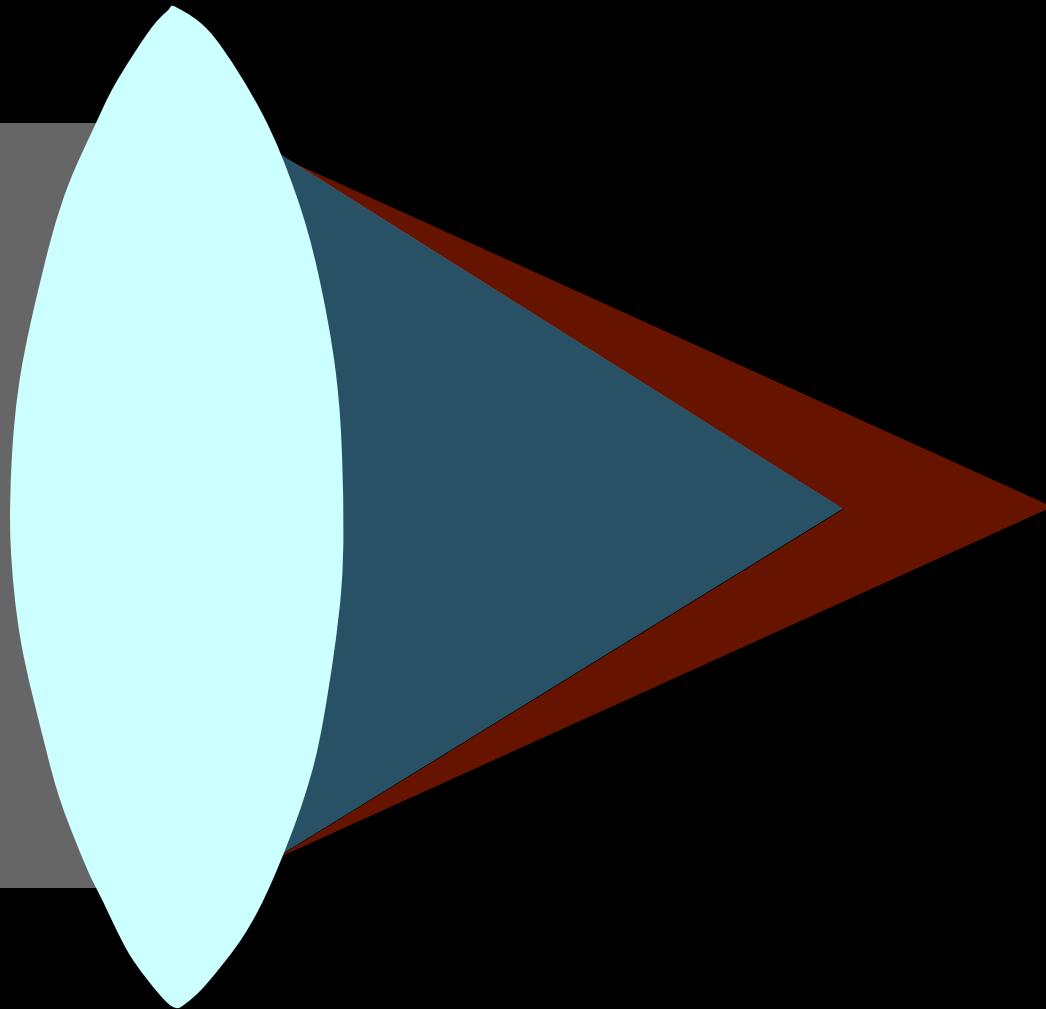


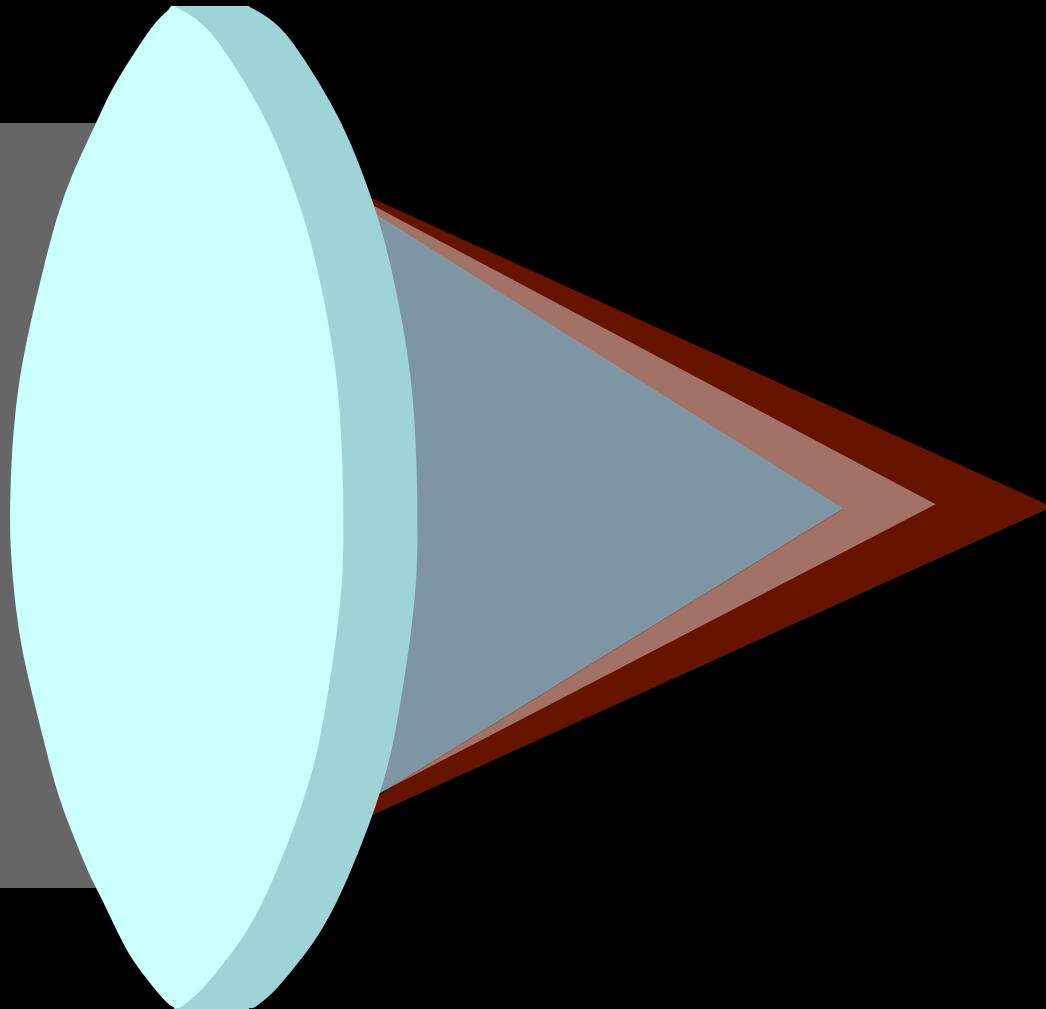
Light gathering power
depends on area

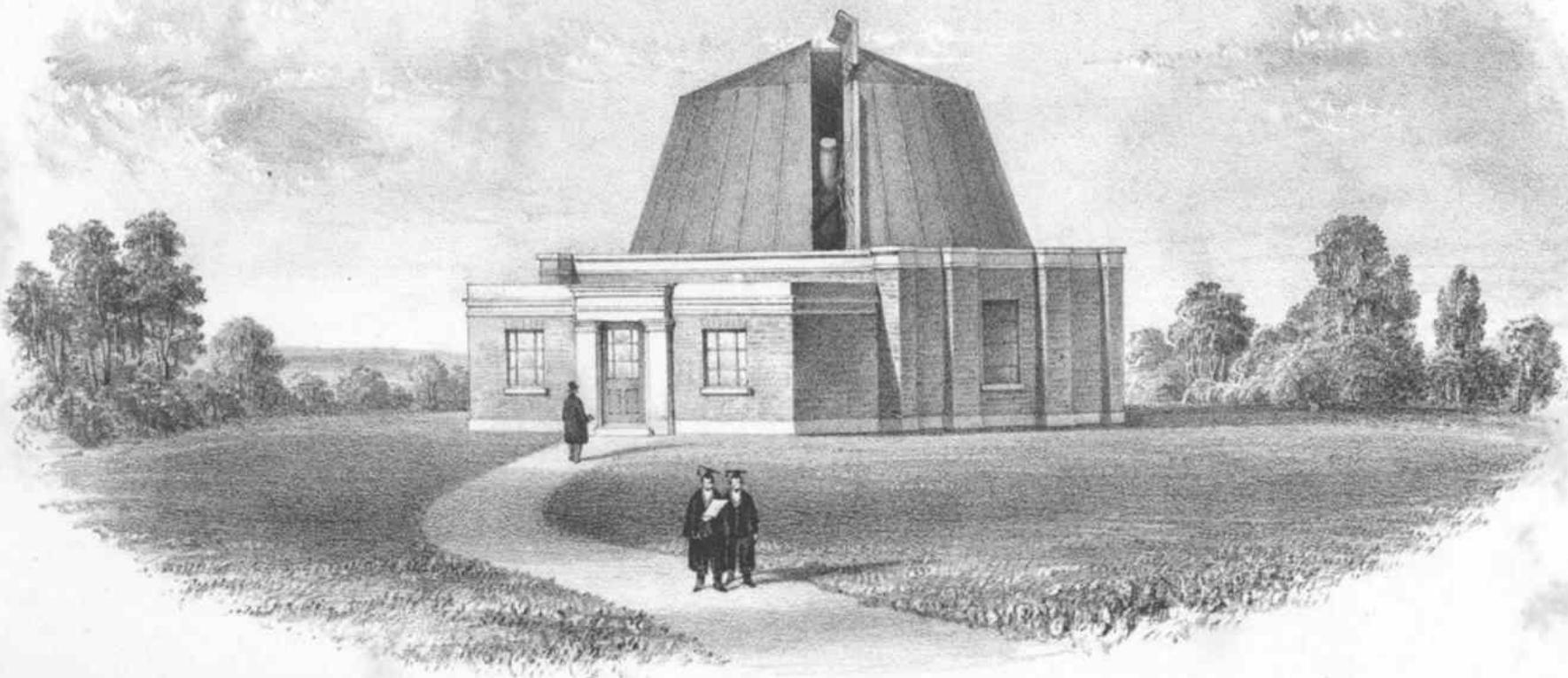
$$\pi \left(\frac{D}{2} \right)^2$$

Magnification

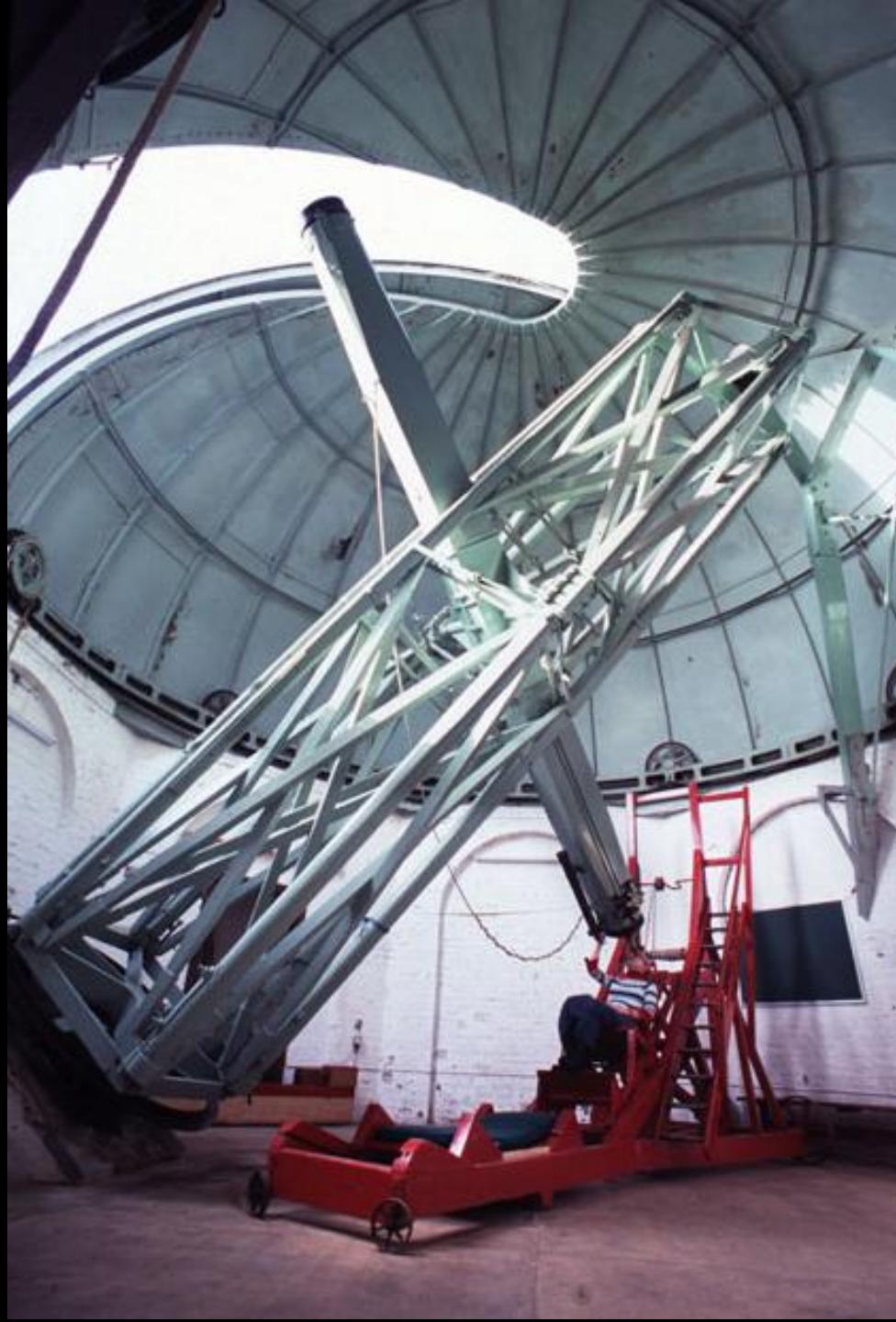
$$\frac{\text{focal length of objective}}{\text{focal length of eyepiece}}$$

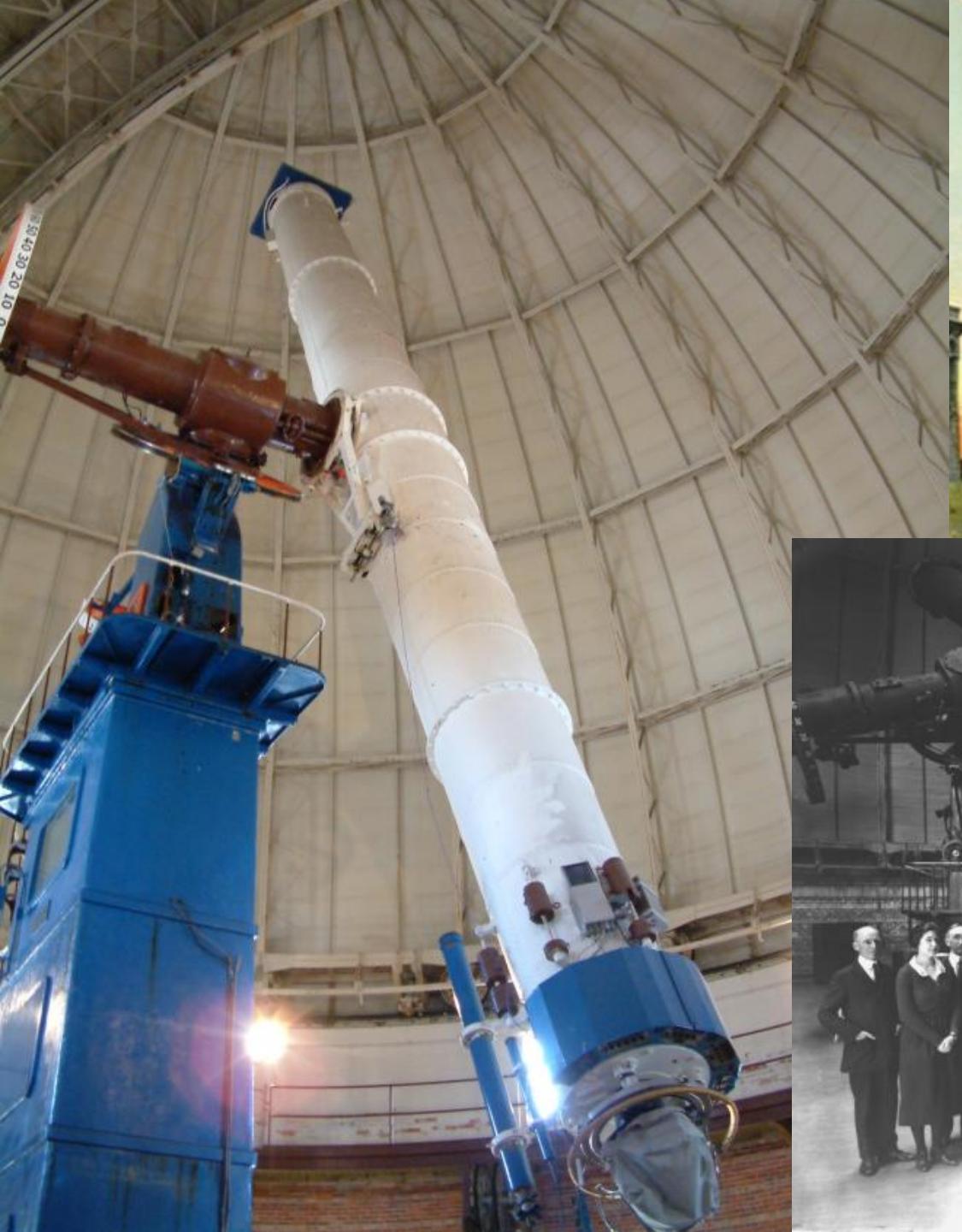




Northumberland Equatorial and Dome.*J. Banister, litho***IoA Library, Cambridge***Fig. 26.—Exterior view of the Dome.*

Amanda Smith



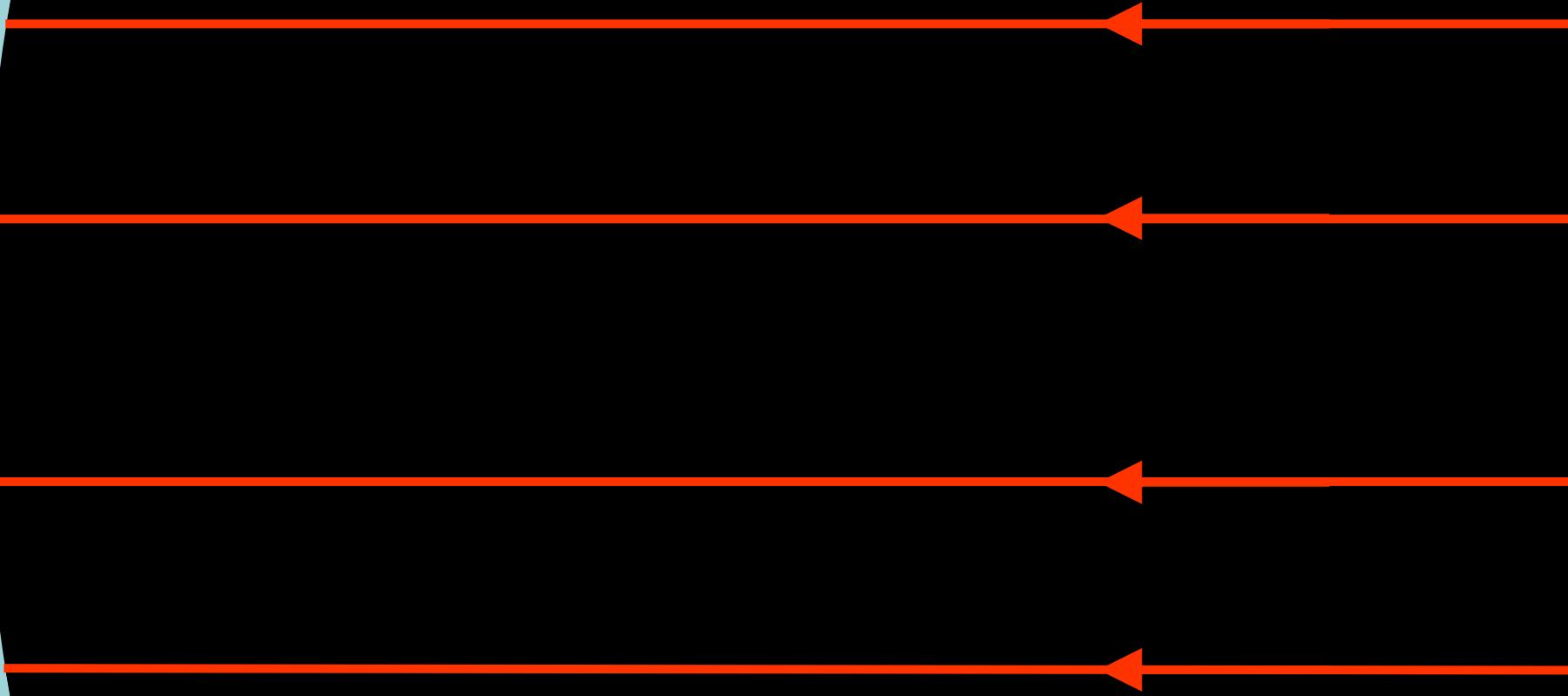


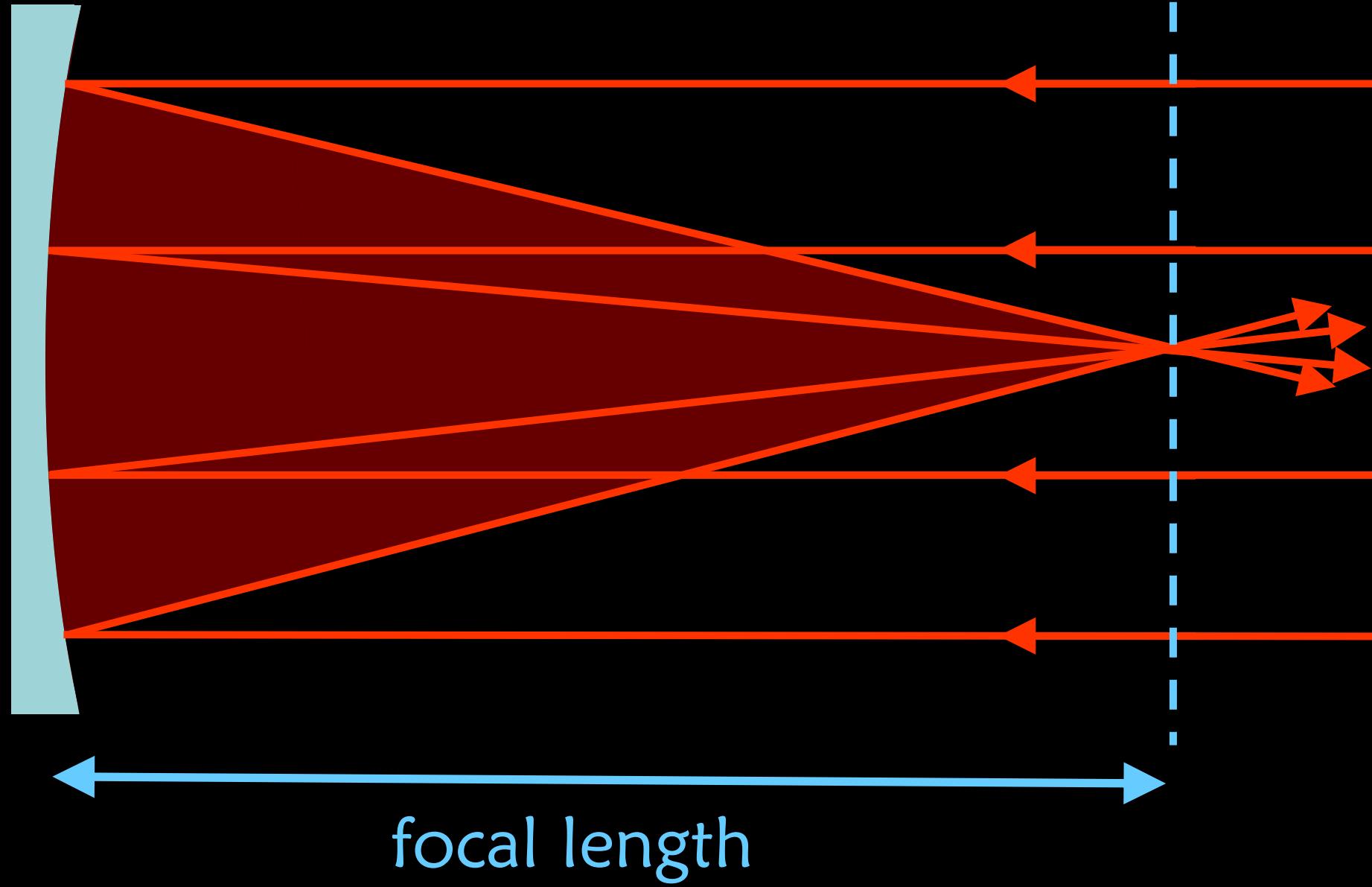
Yerkes Observatory
University of Chicago

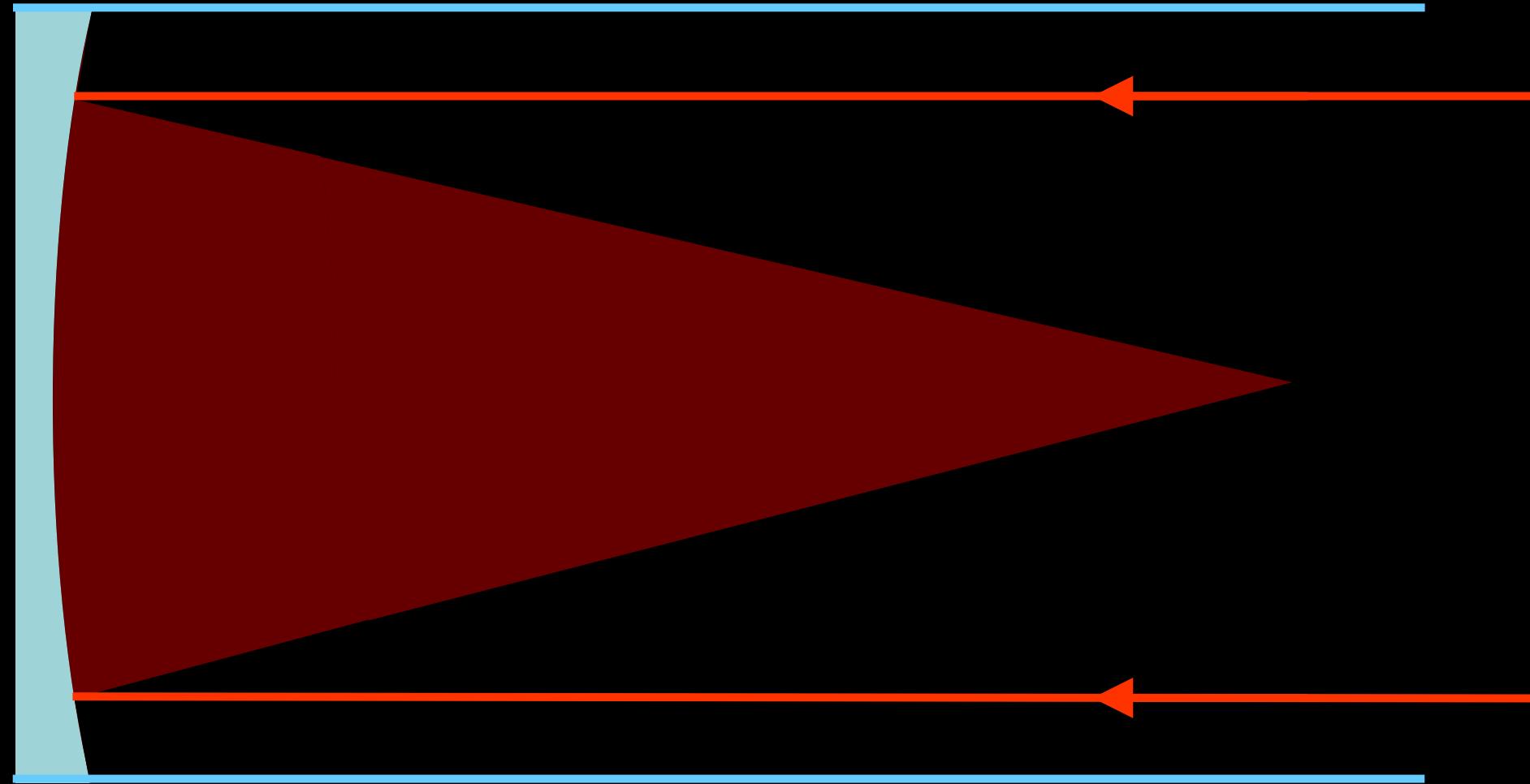




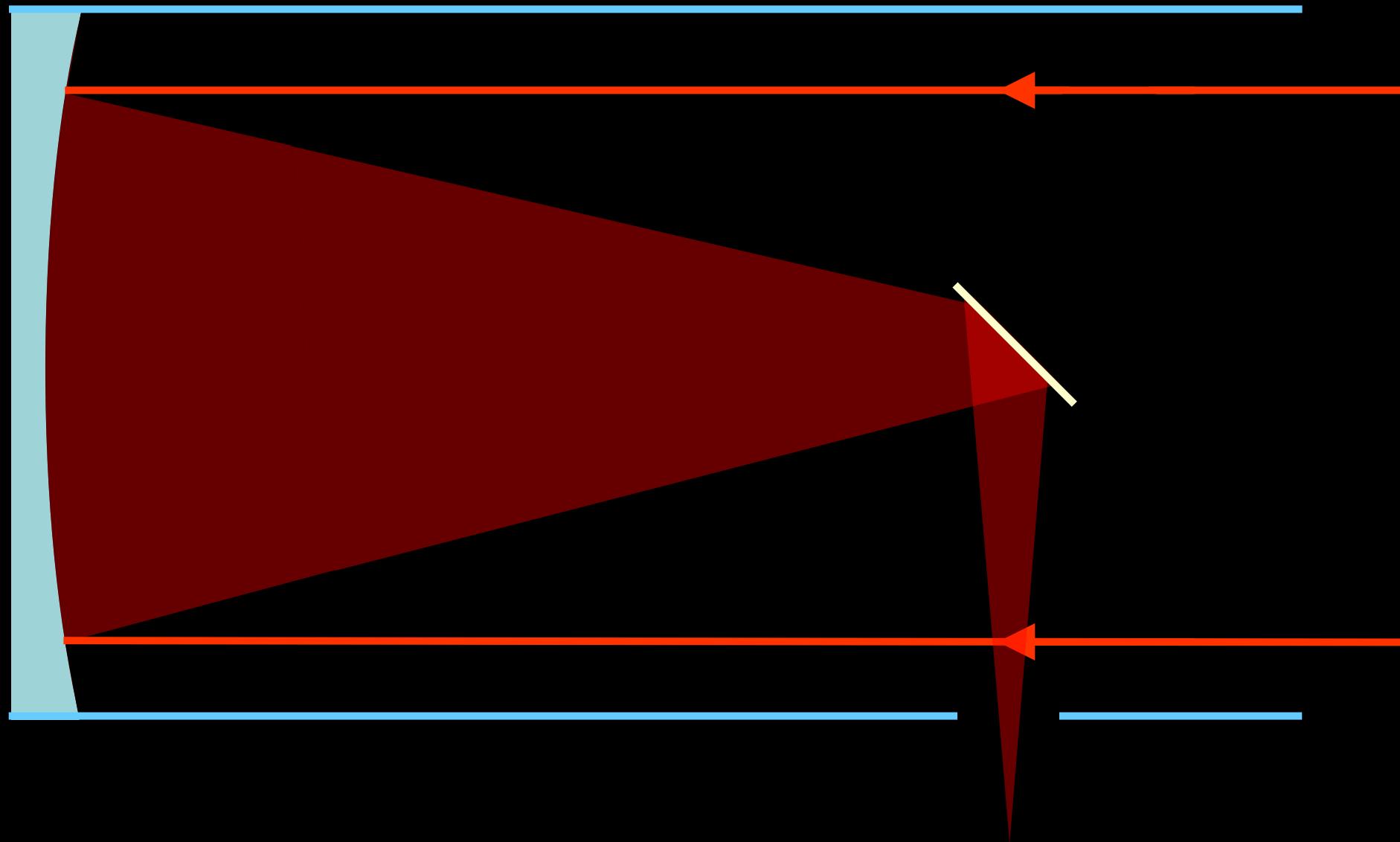
IoA Library, Cambridge





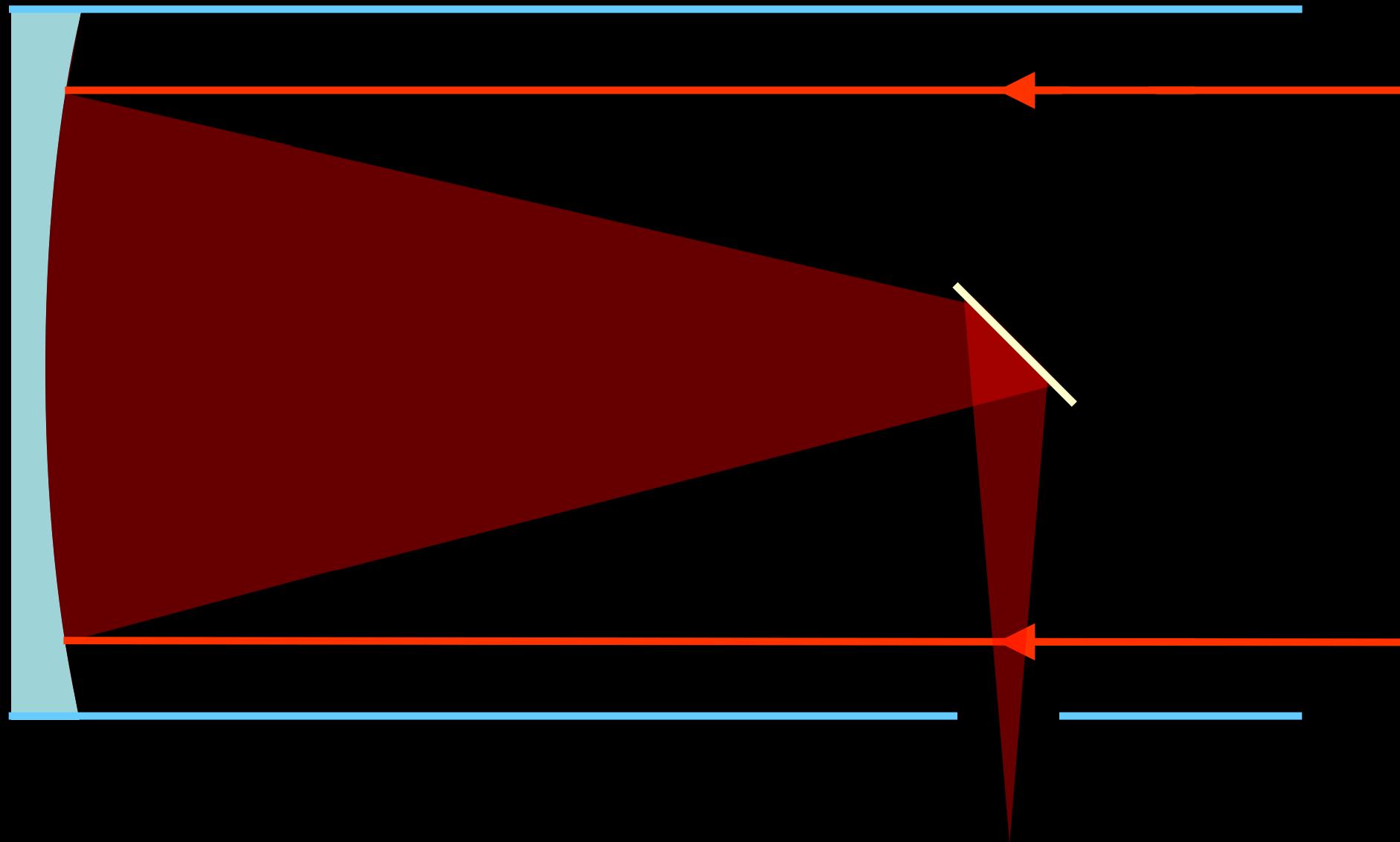


Newtonian focus

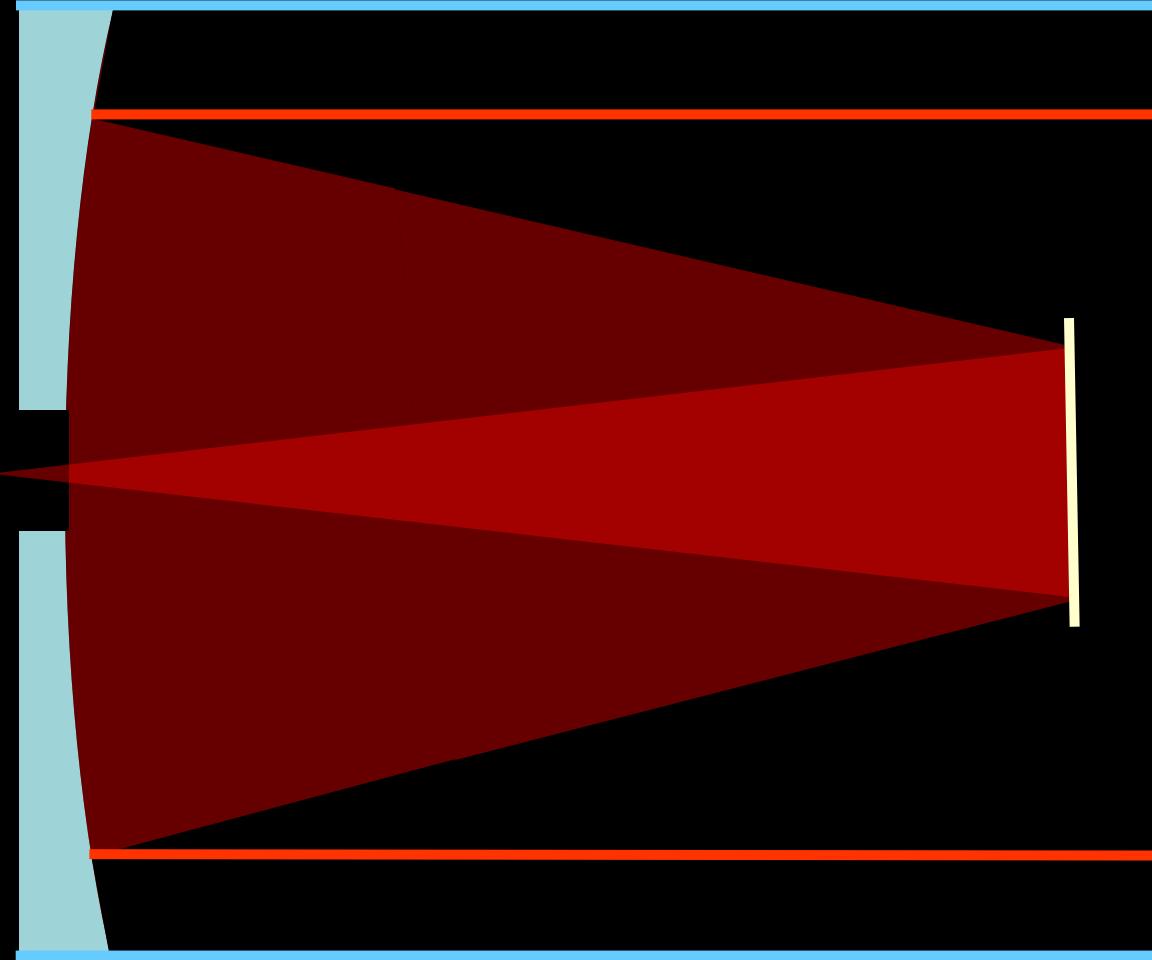


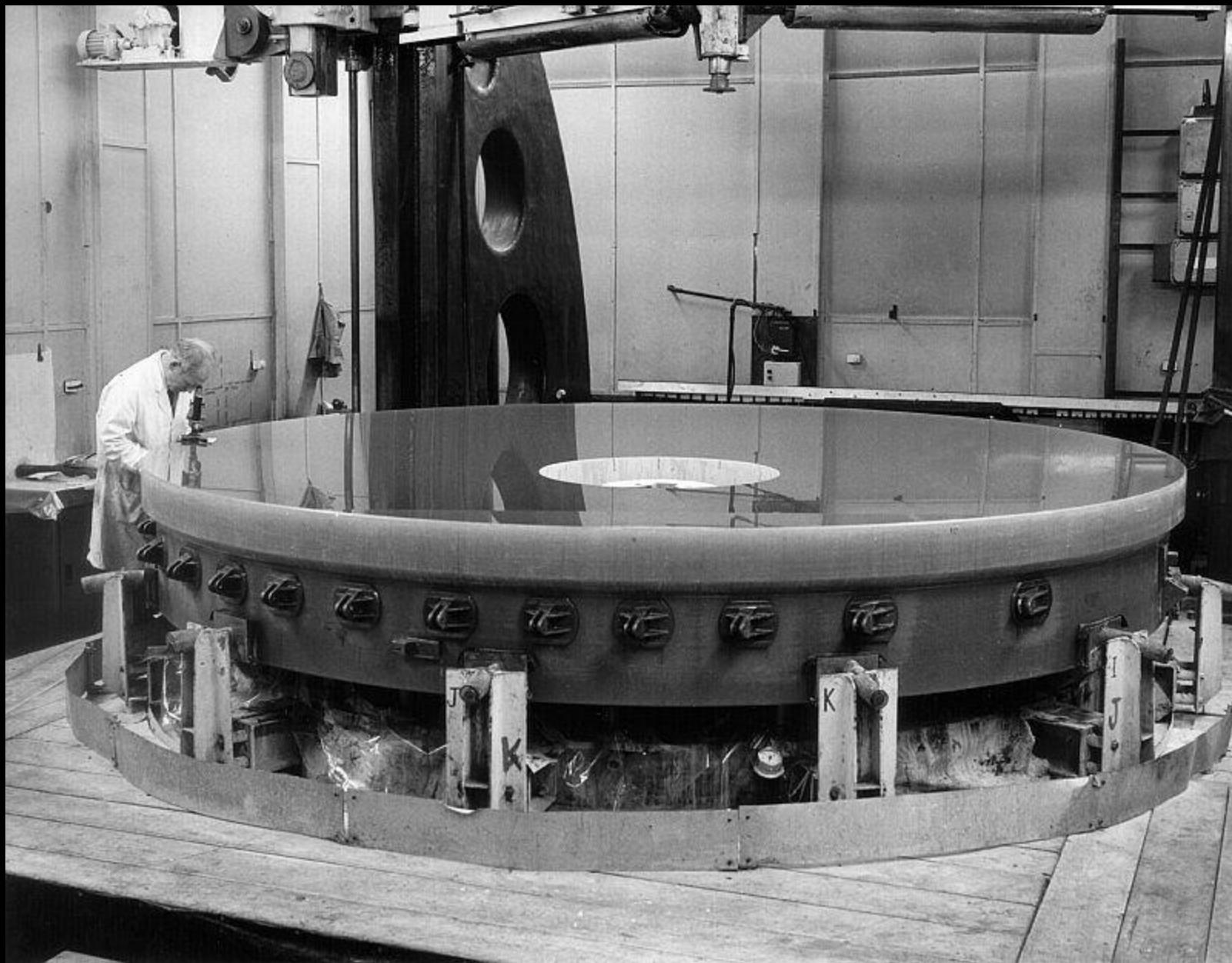


Newtonian focus

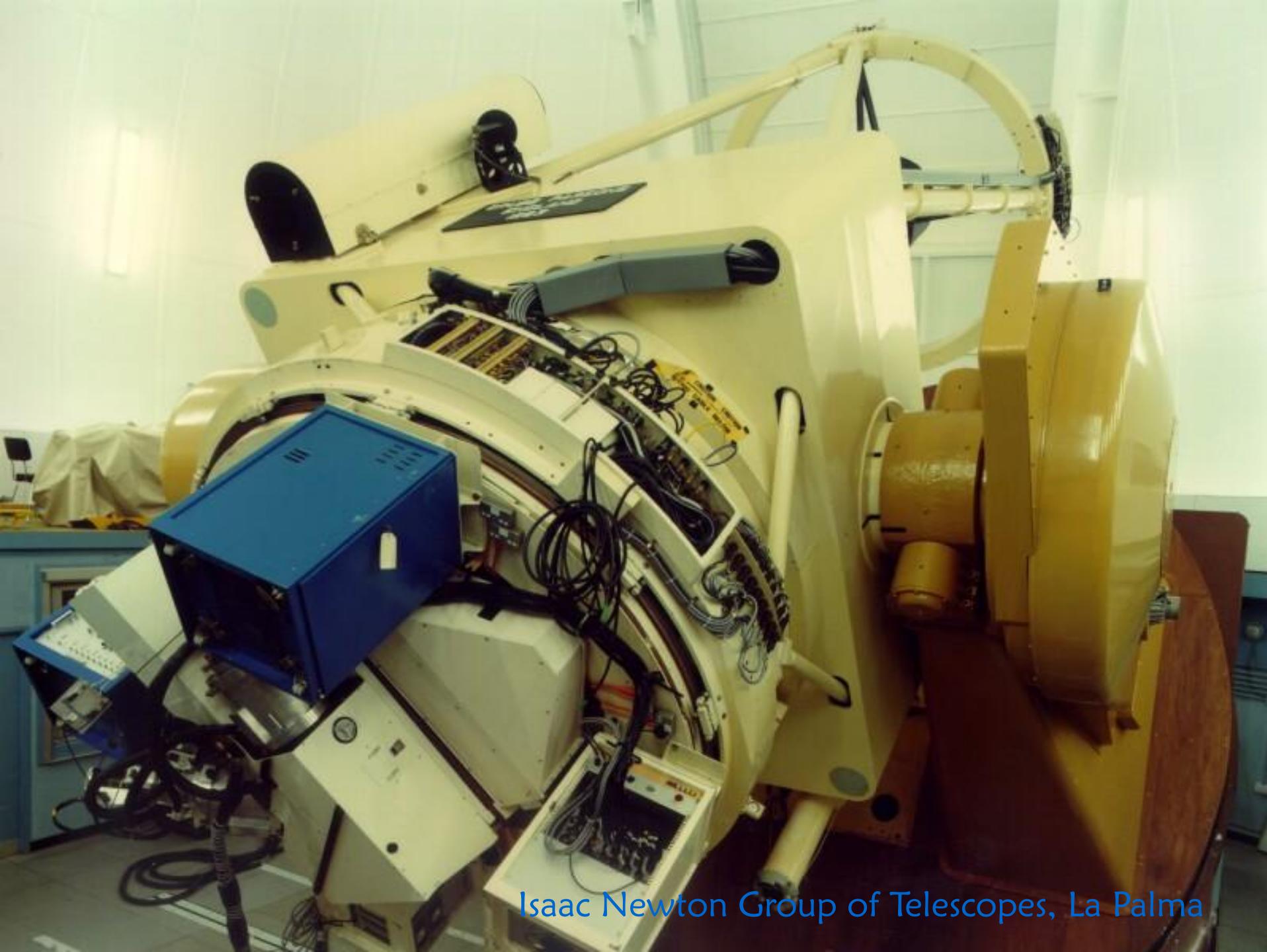


Cassegrain focus





Royal Greenwich Observatory

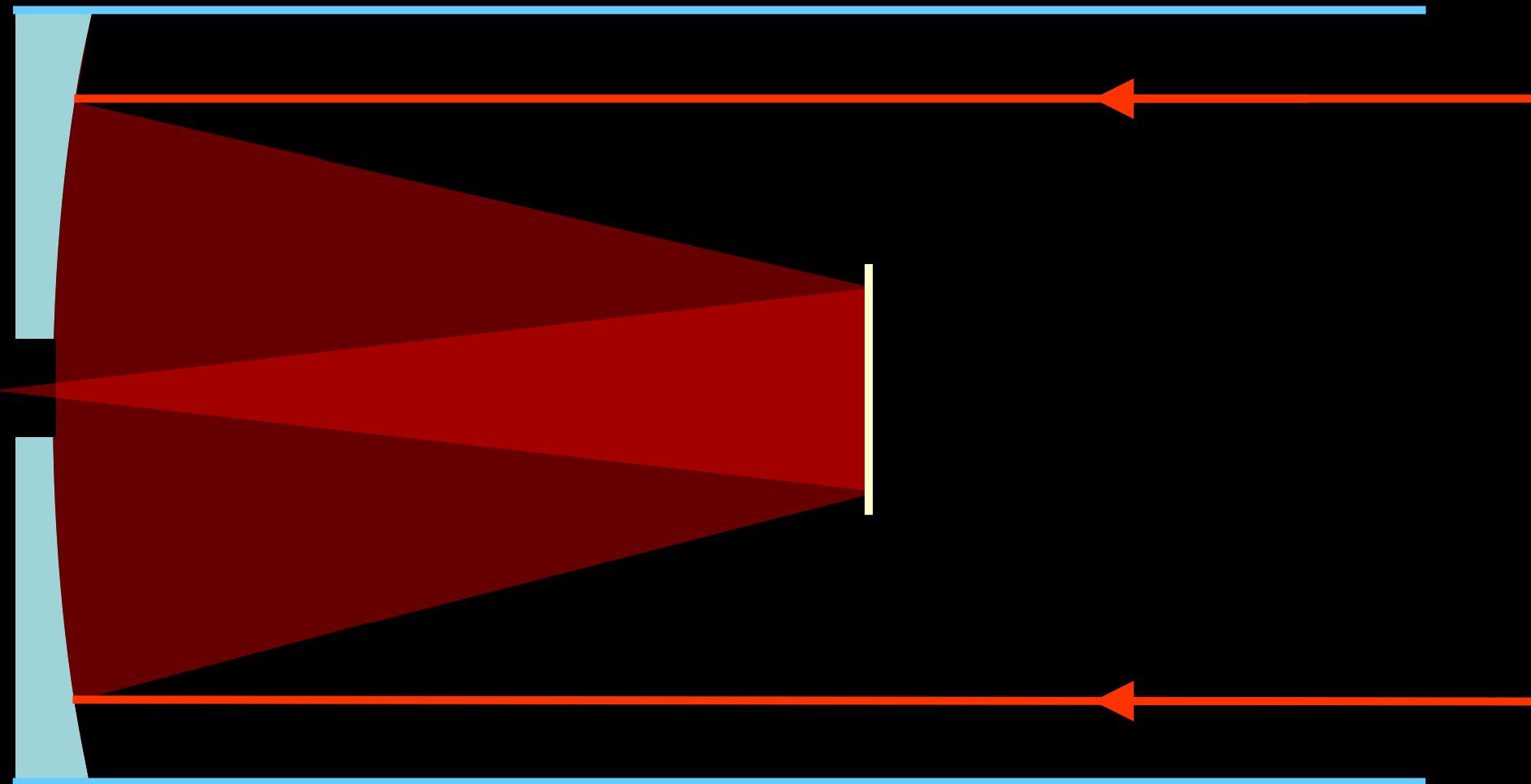


Isaac Newton Group of Telescopes, La Palma

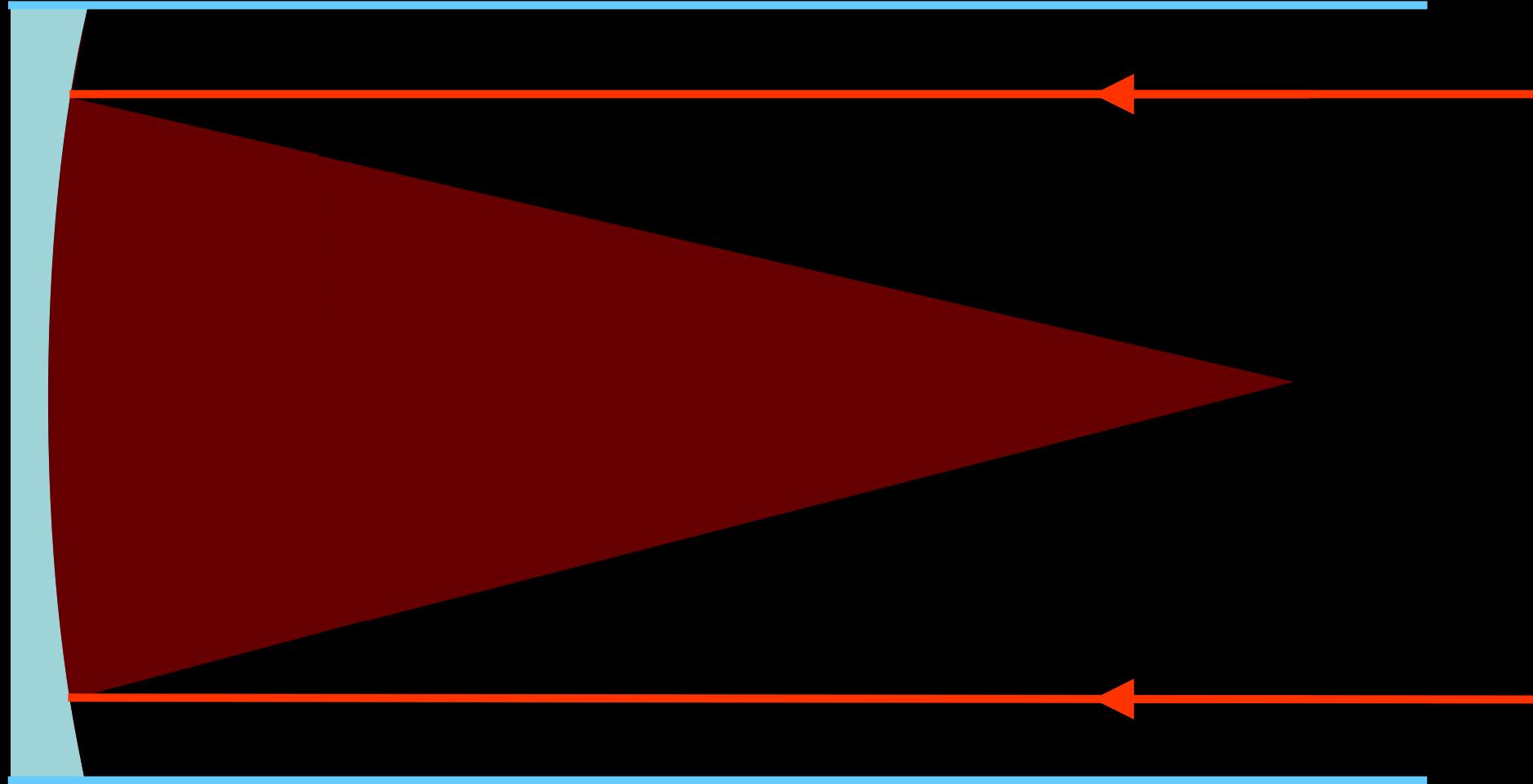


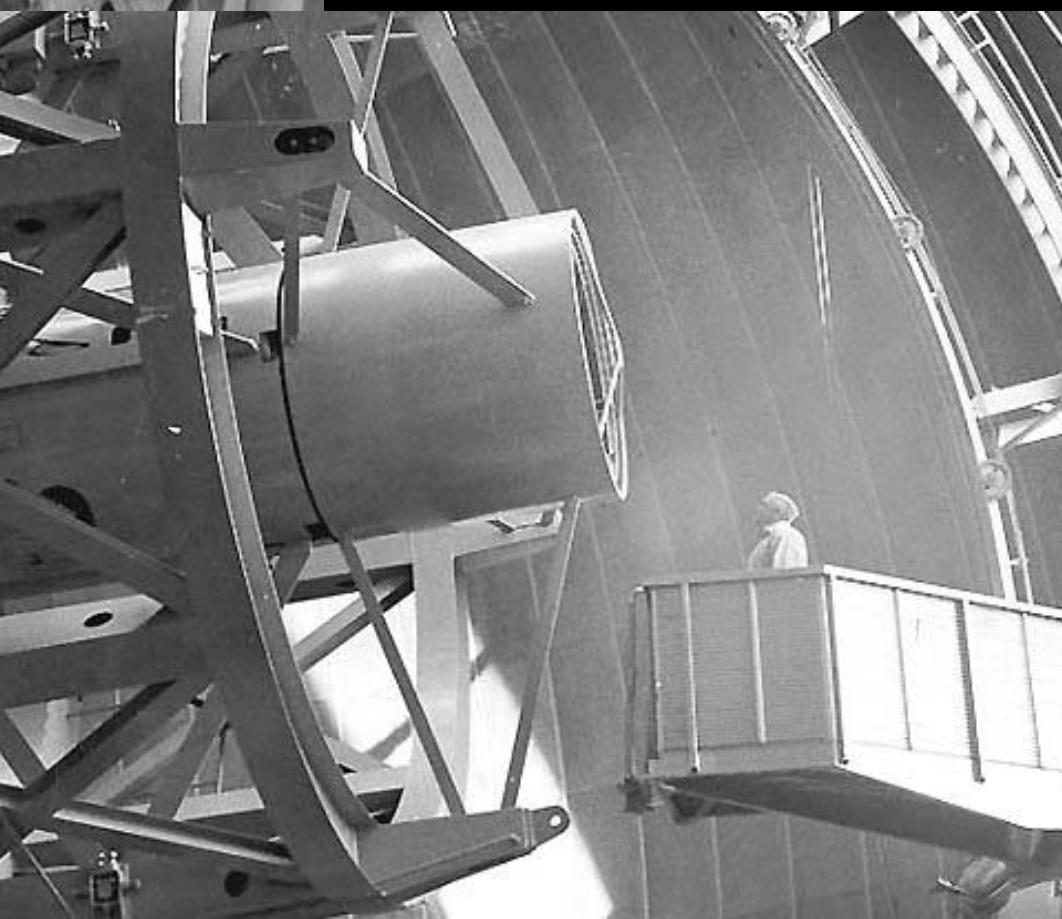
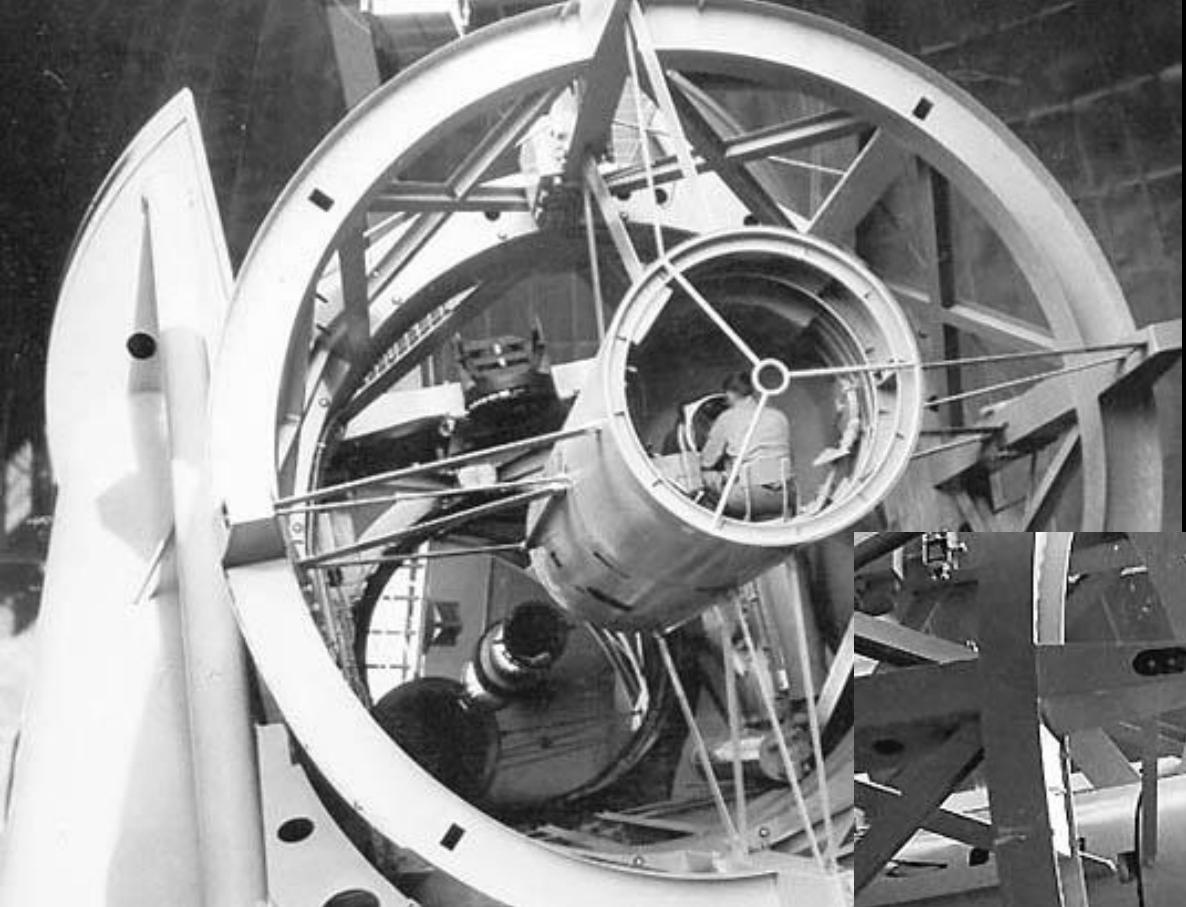
Jens Moser

Cassegrain focus



Prime focus



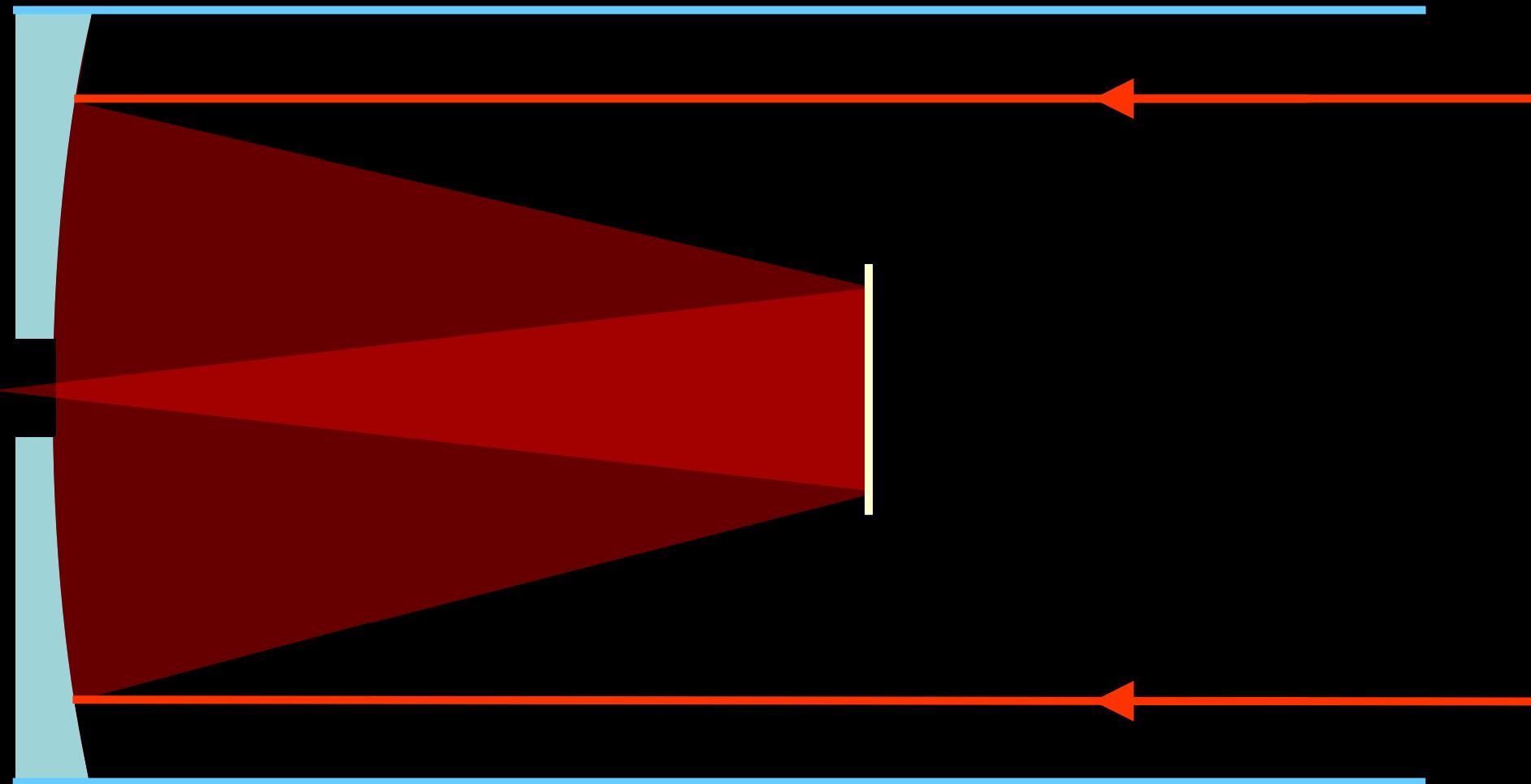


University of San Diego

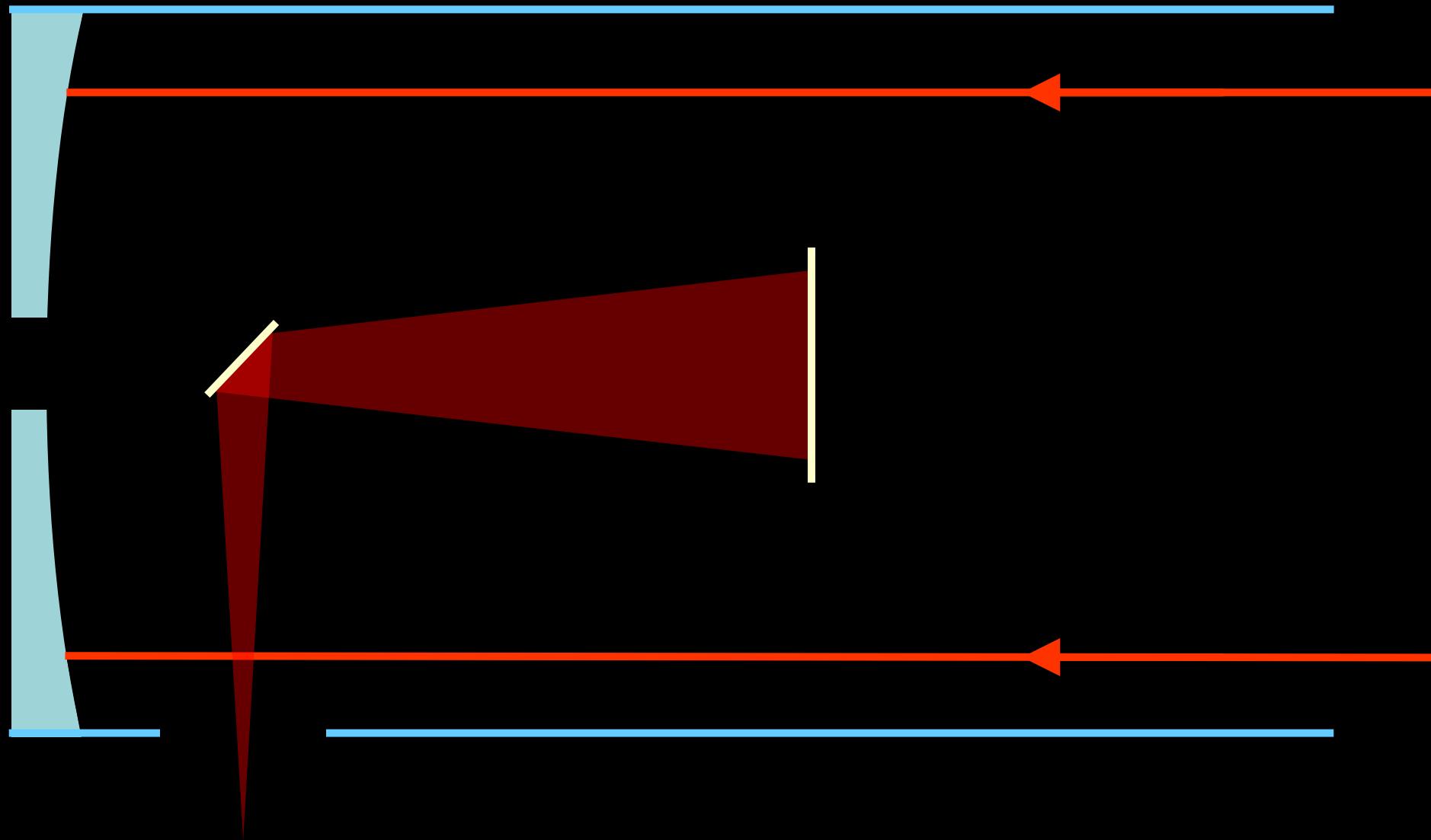


David Malin

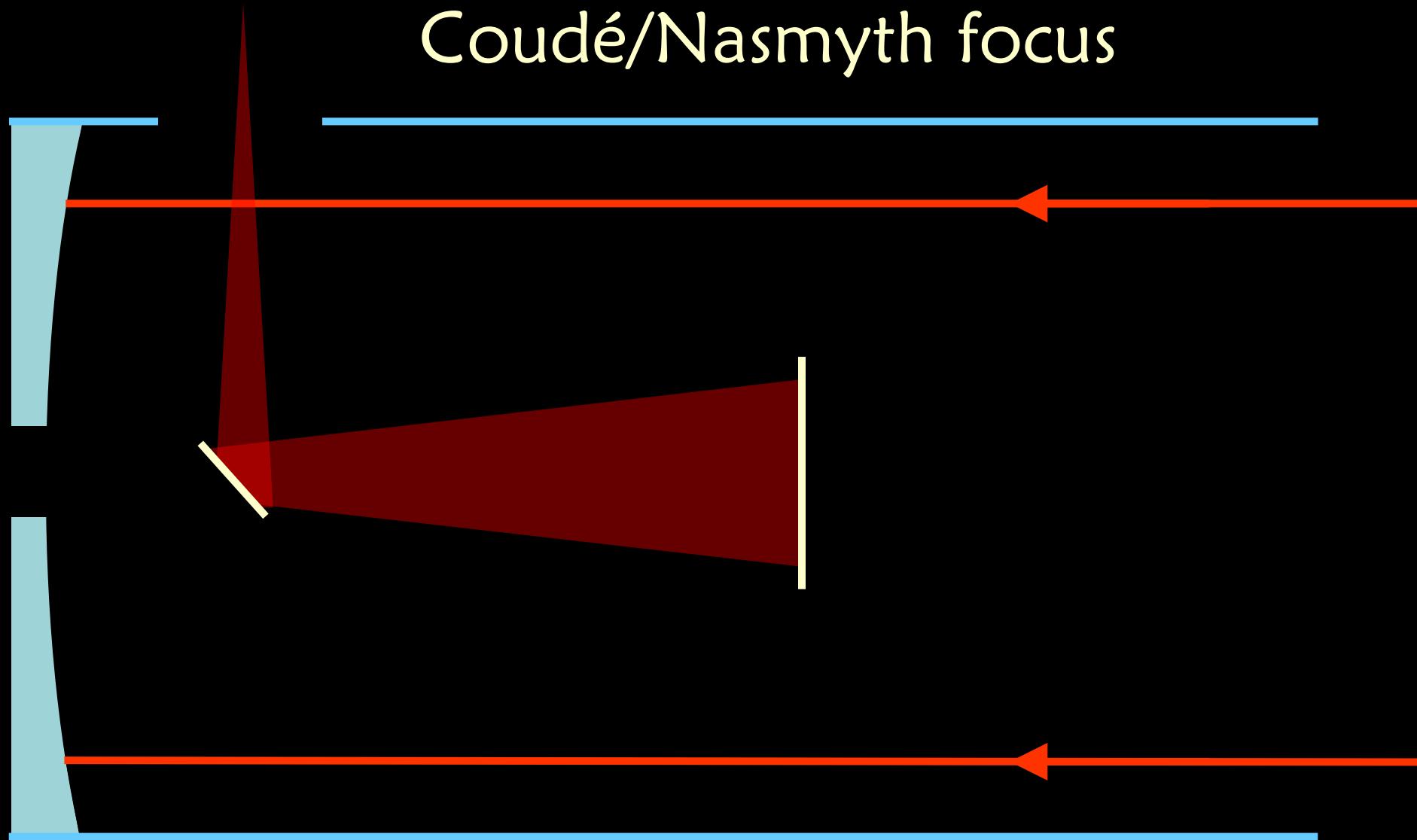
Cassegrain focus

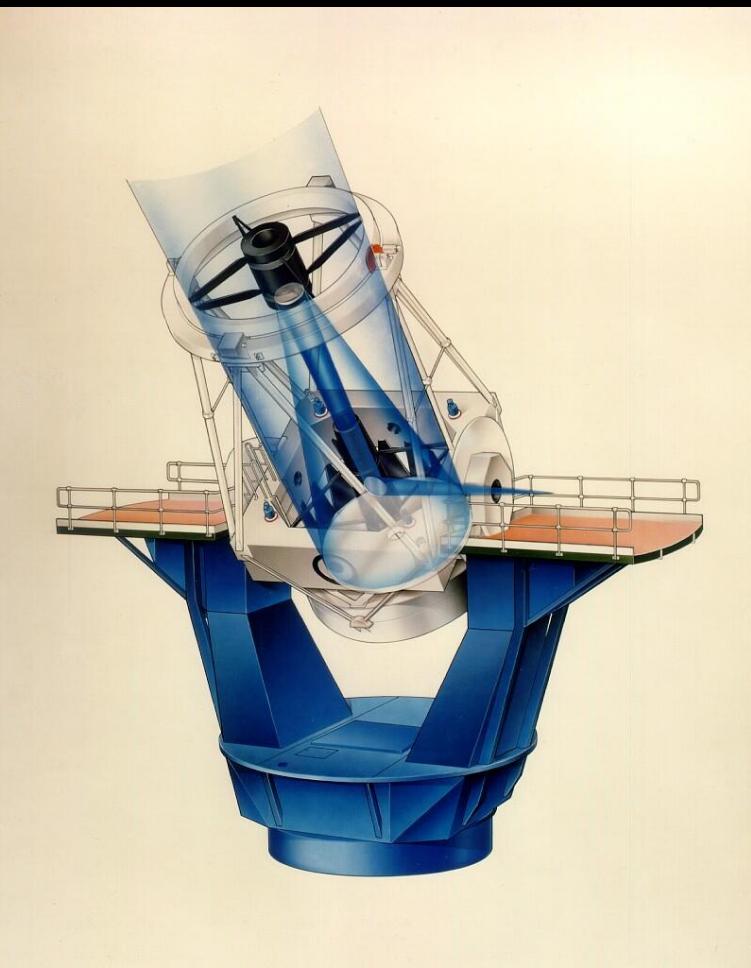


Coudé/Nasmyth focus



Coudé/Nasmyth focus

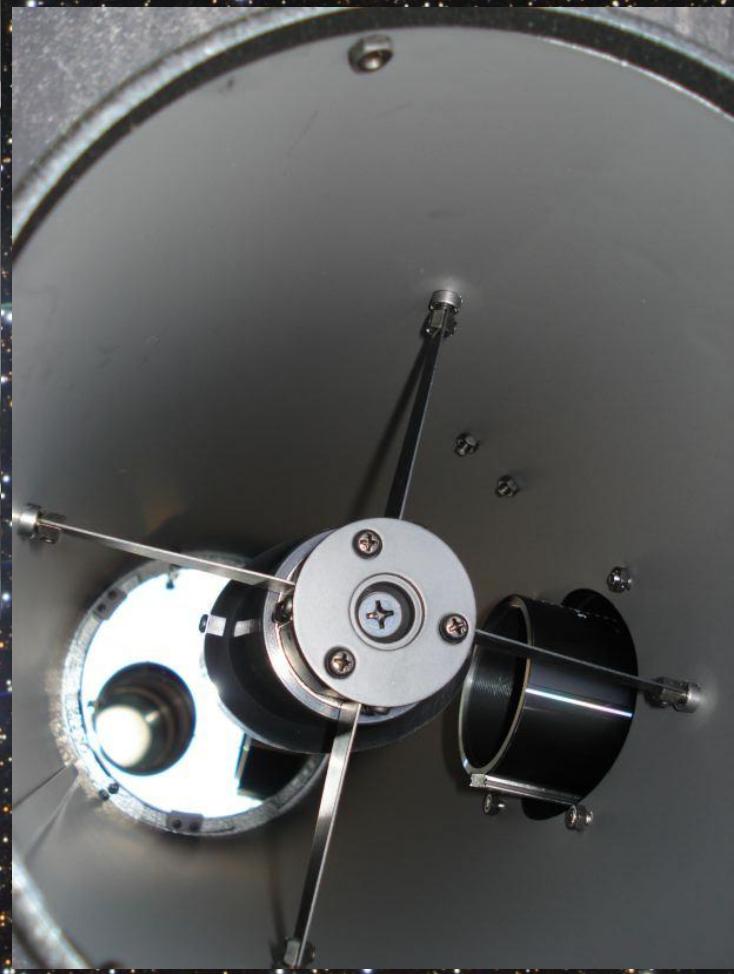
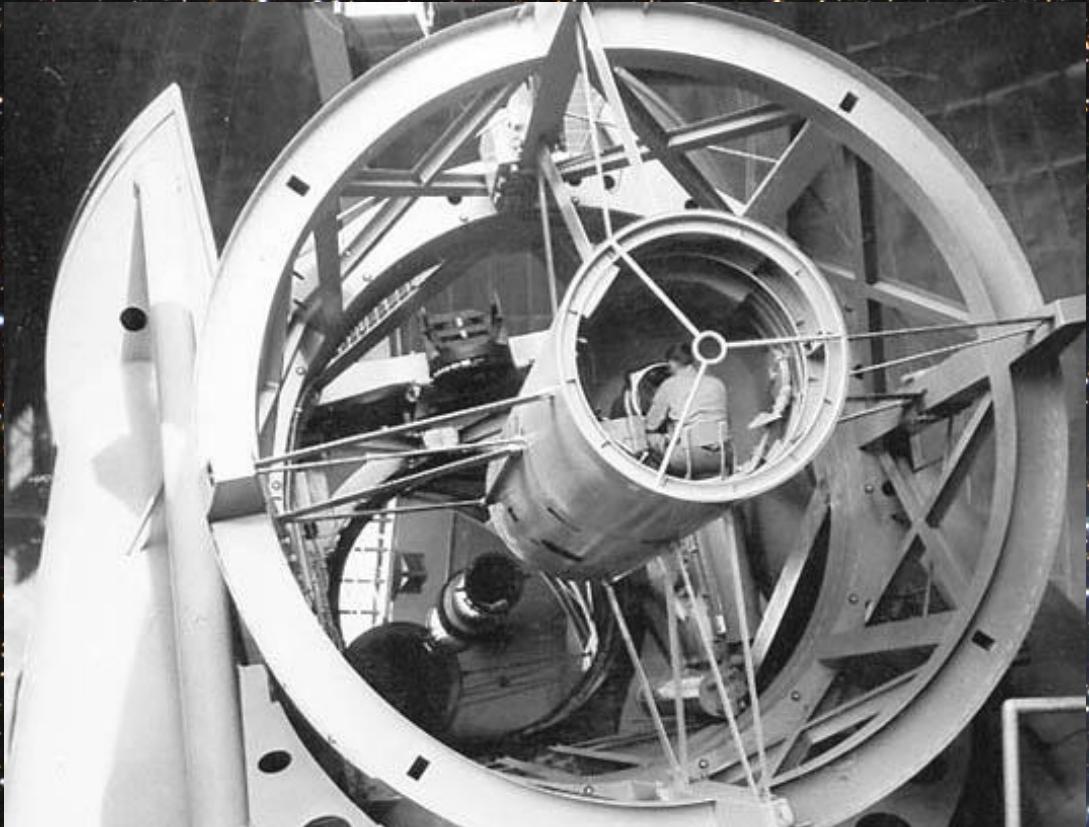




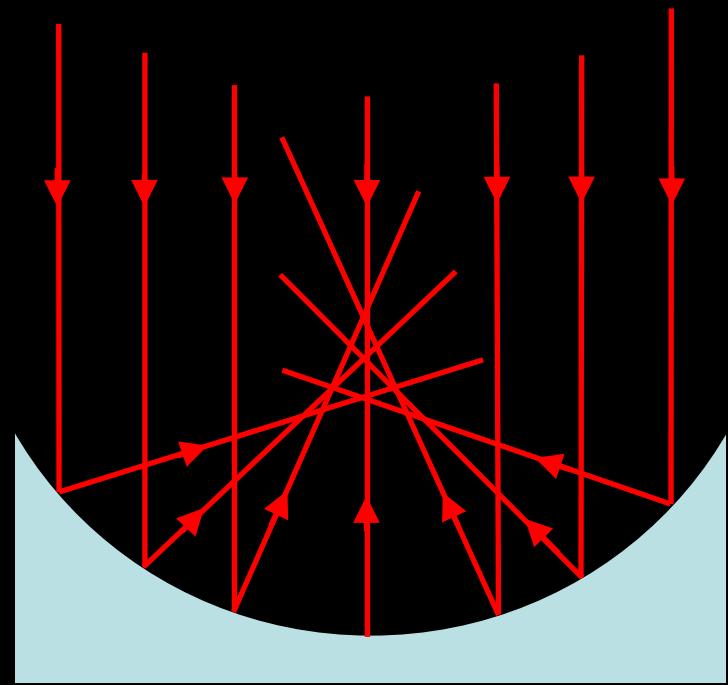
Jens Moser
Isaac Newton Group, La Palma

A photograph of a star cluster, likely M45 (The Pleiades), showing numerous blue and white stars of varying brightness. The stars are densely packed in the center and become more sparse towards the edges.

Dieter Willasch (Astro-Cabinet)



Dieter Willasch (Astro-Cabinet)



Spherical Mirror

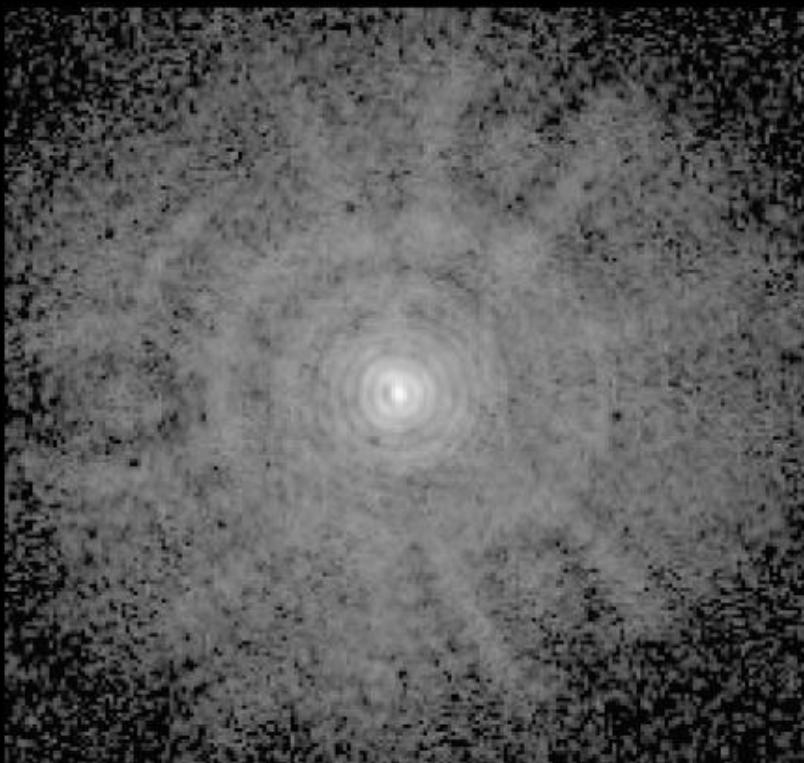


NASA

HUBBLE SPACE TELESCOPE

FAINT OBJECT CAMERA

COMPARATIVE VIEWS OF A STAR



BEFORE COSTAR



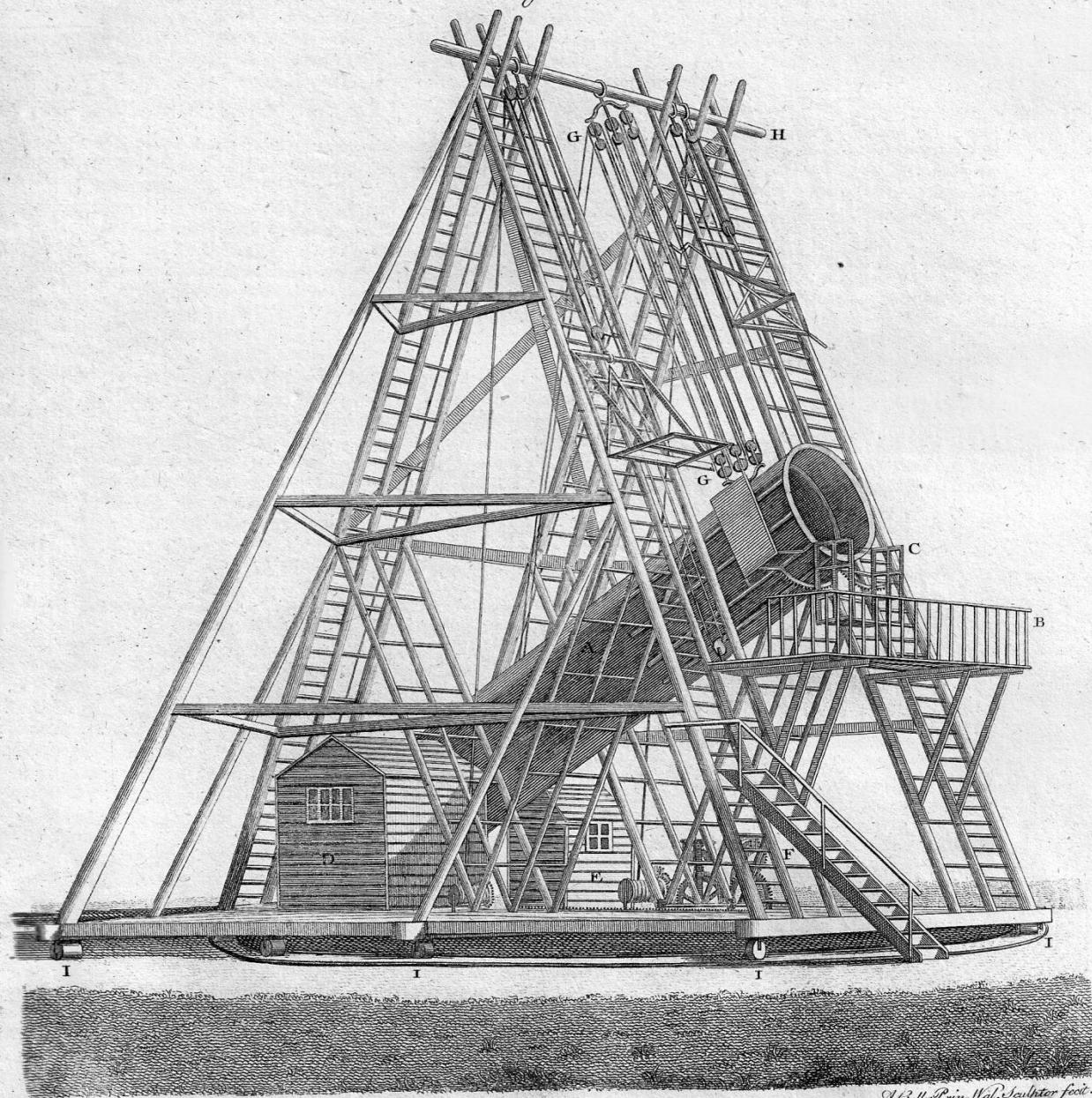
AFTER COSTAR

Hubble News Center

Herschel's Grand
TELESCOPE.

Fig. 24.

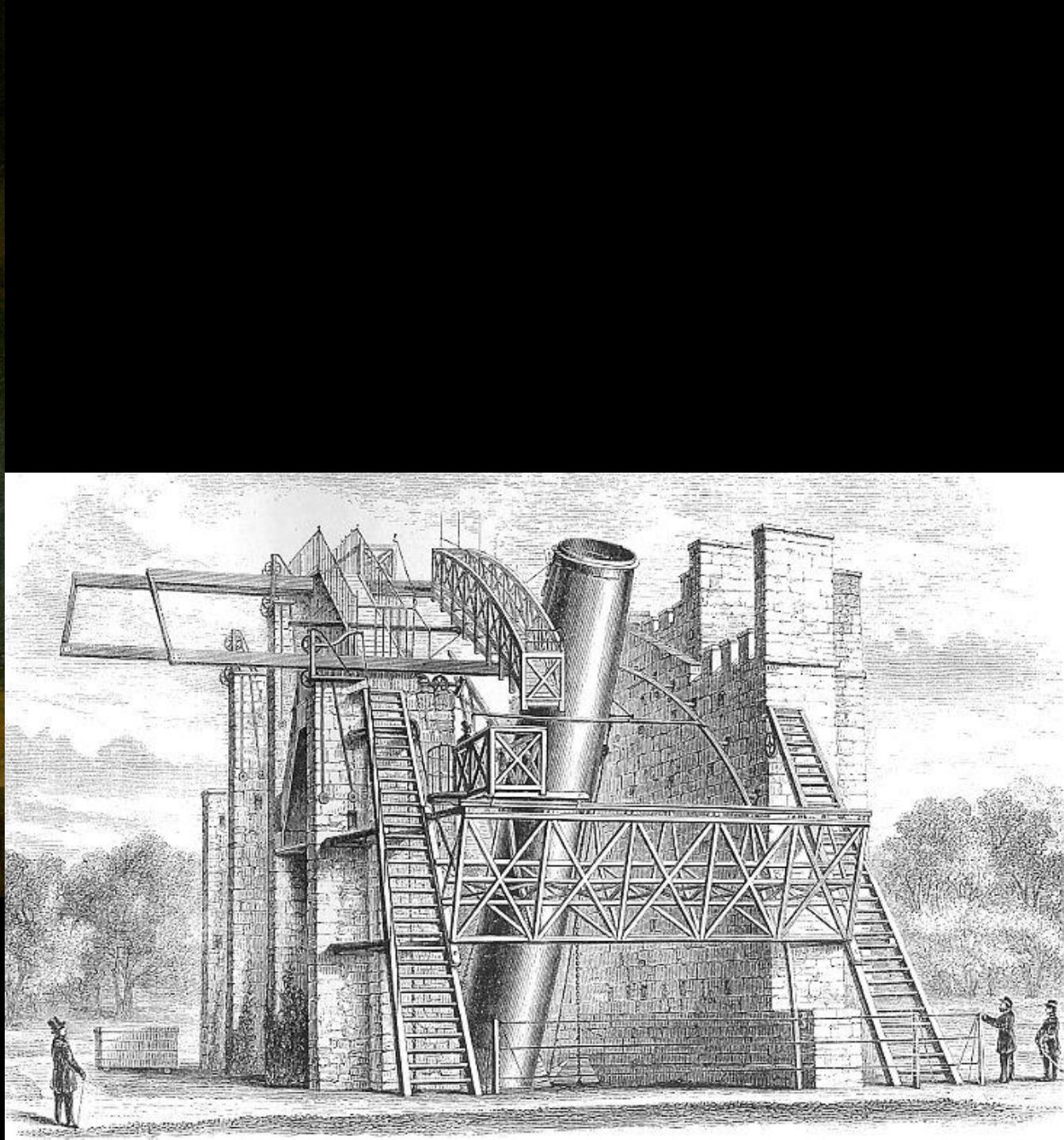
Plate DV.



William Herschel
(1738-1822)



Lord Rosse
(1800-1867)



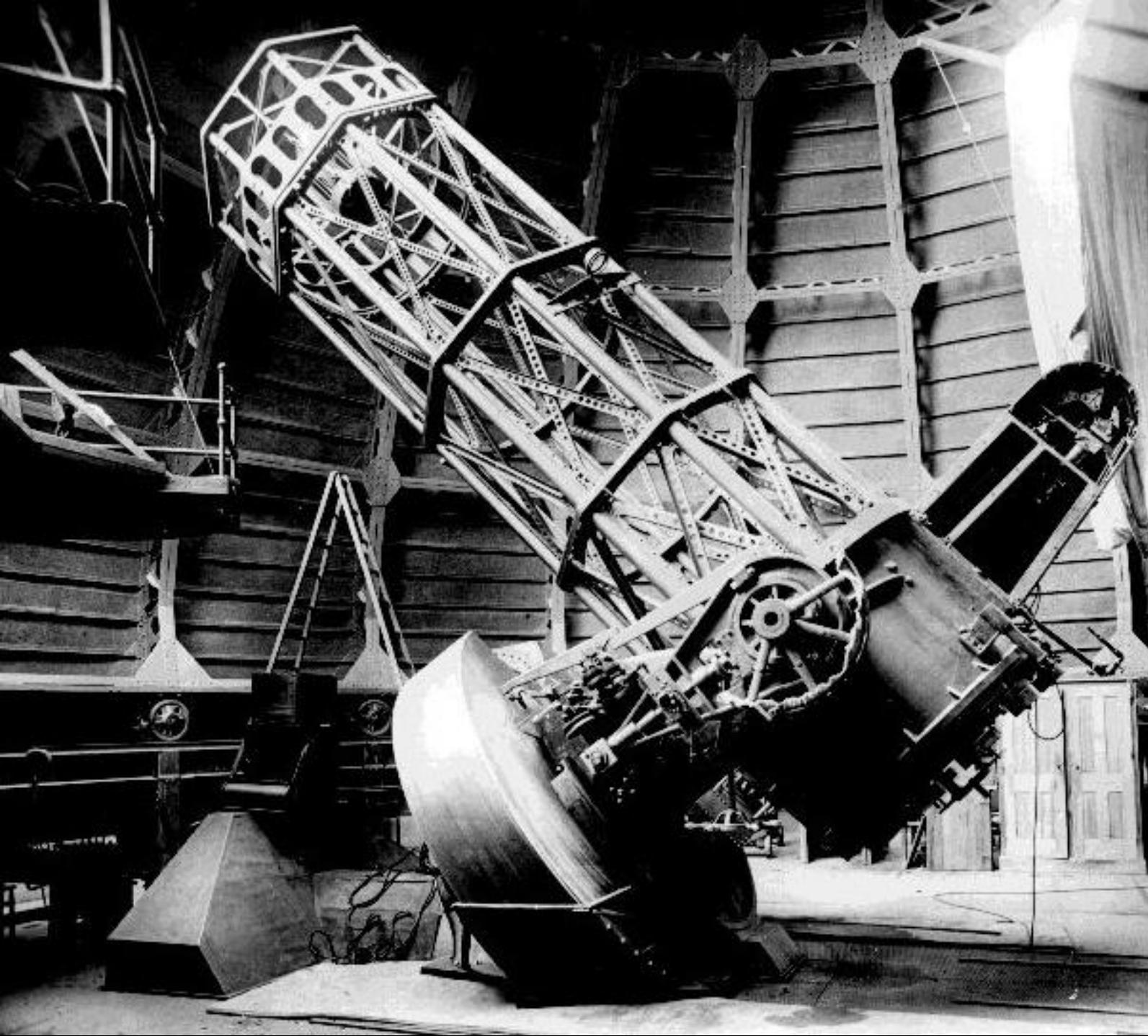


Hubble Space Telescope

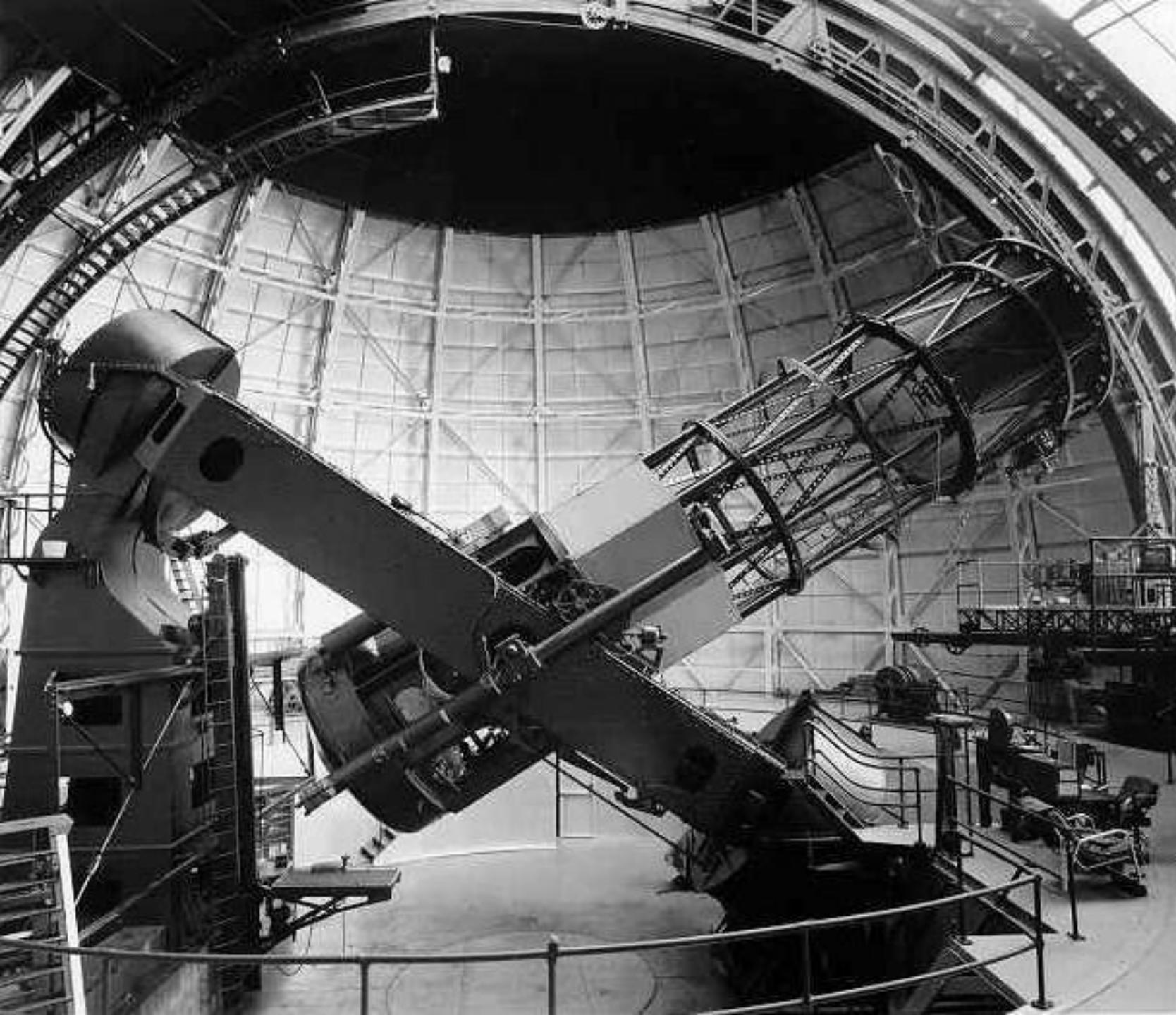




Mt Wilson Observatory



Caltech
archives



Caltech
archives

Palomar Observatory



Prime Focus Cage
660 Inches f/3.5

Prime Focus
Elevator

2nd Flat
in 5-Mirror
Coudé System

Right Ascension
Drive

Coudé Focus
6000 Inches f/30

Coudé and
Cassegrain
Mirrors

North Polar
Axis Horseshoe
Bearing

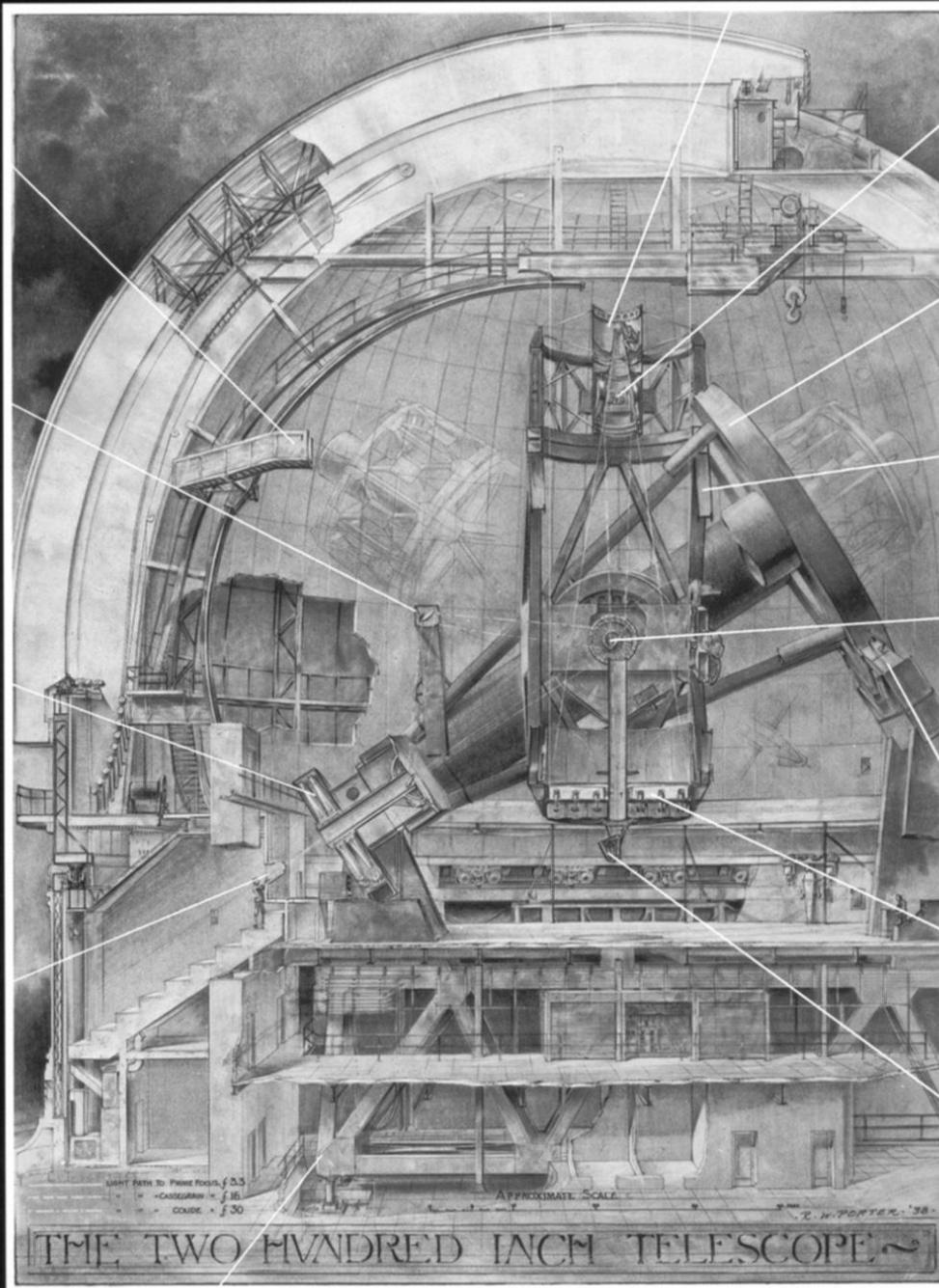
Main Telescope
Tube

Declination Axis

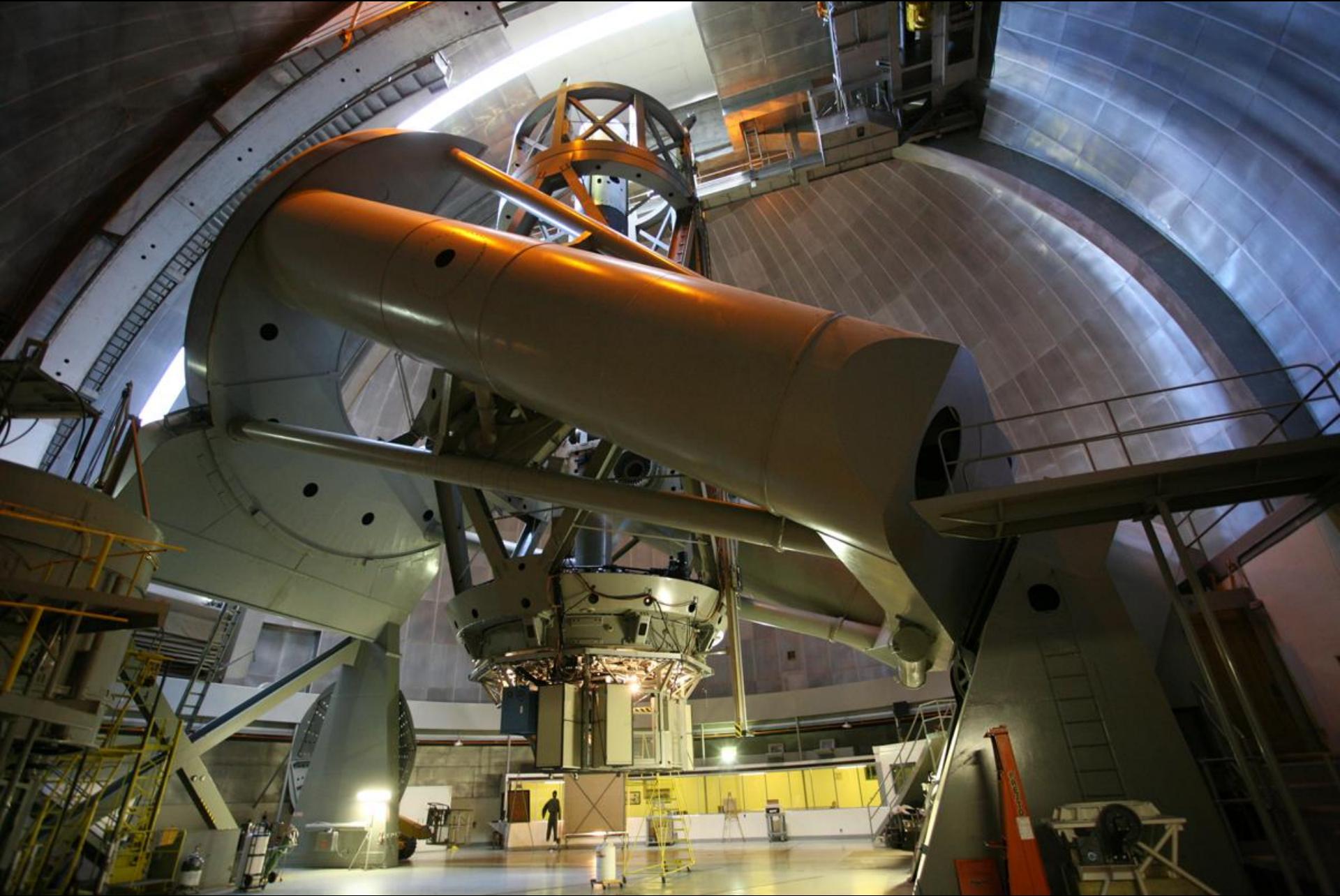
North Oil Pad
Bearings

200 Inch Mirror

Cassegrain Focus
3200 Inches f/16



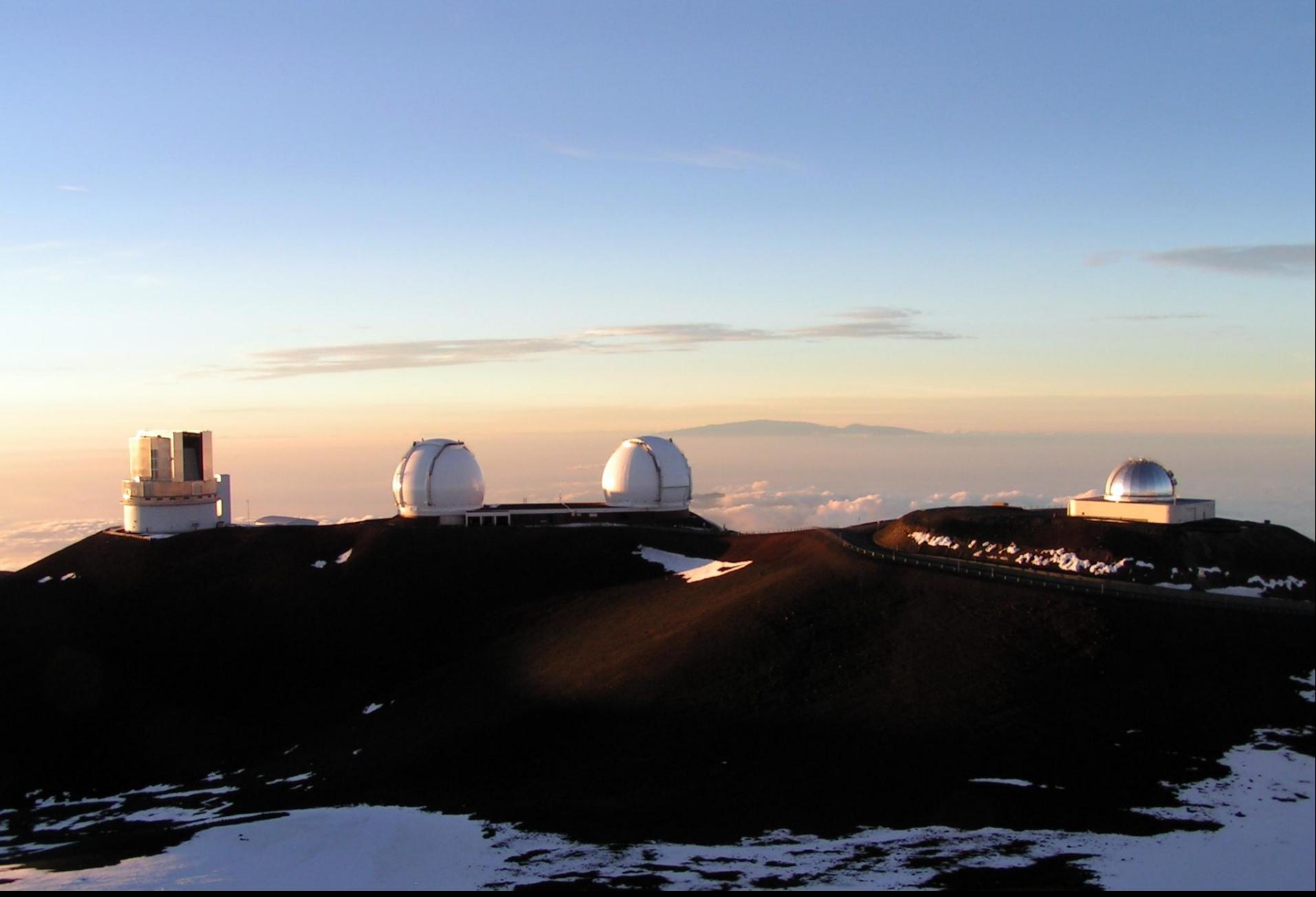
Palomar Observatory



Kardel, Palomar Observatory



Gemini Observatory

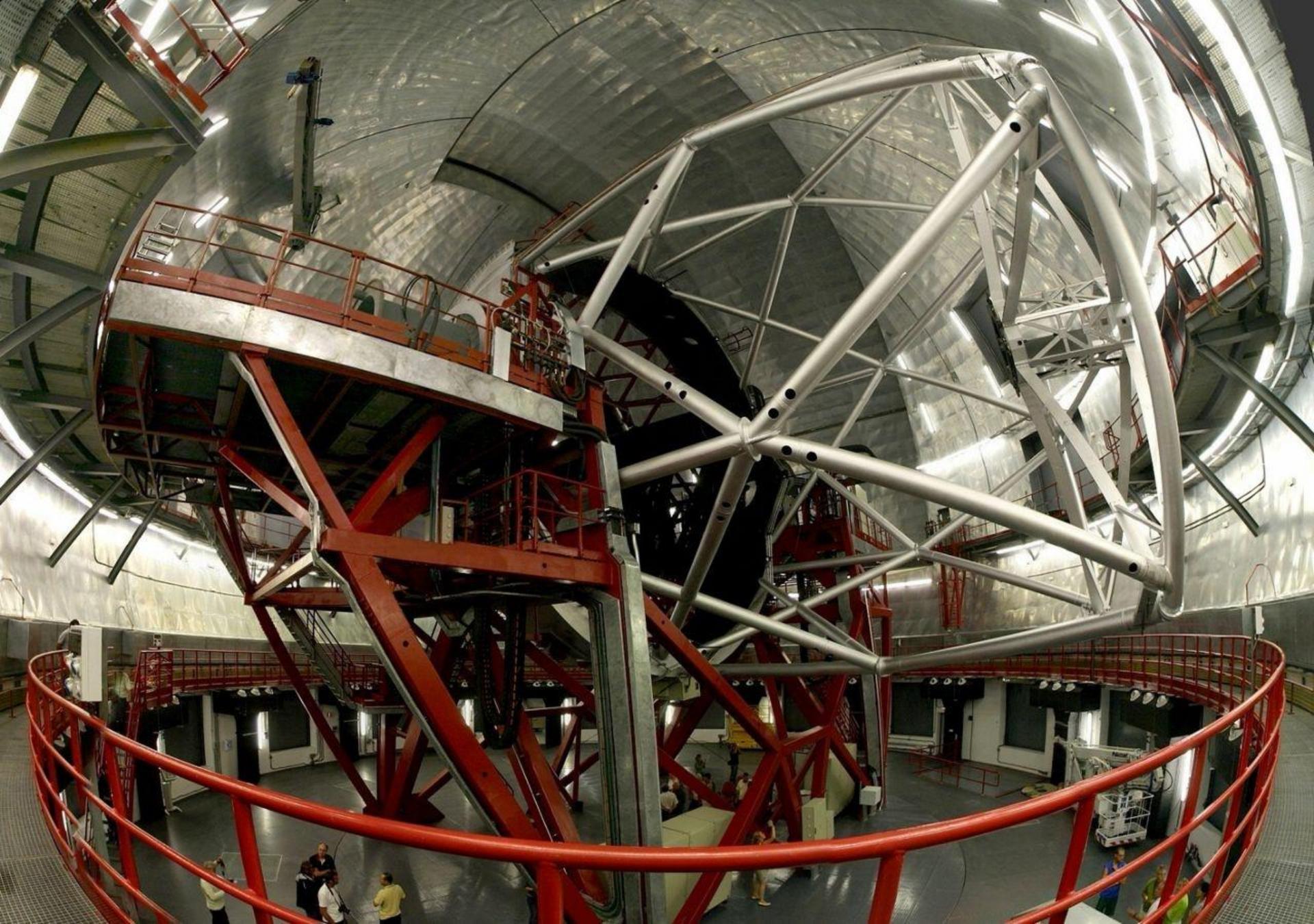




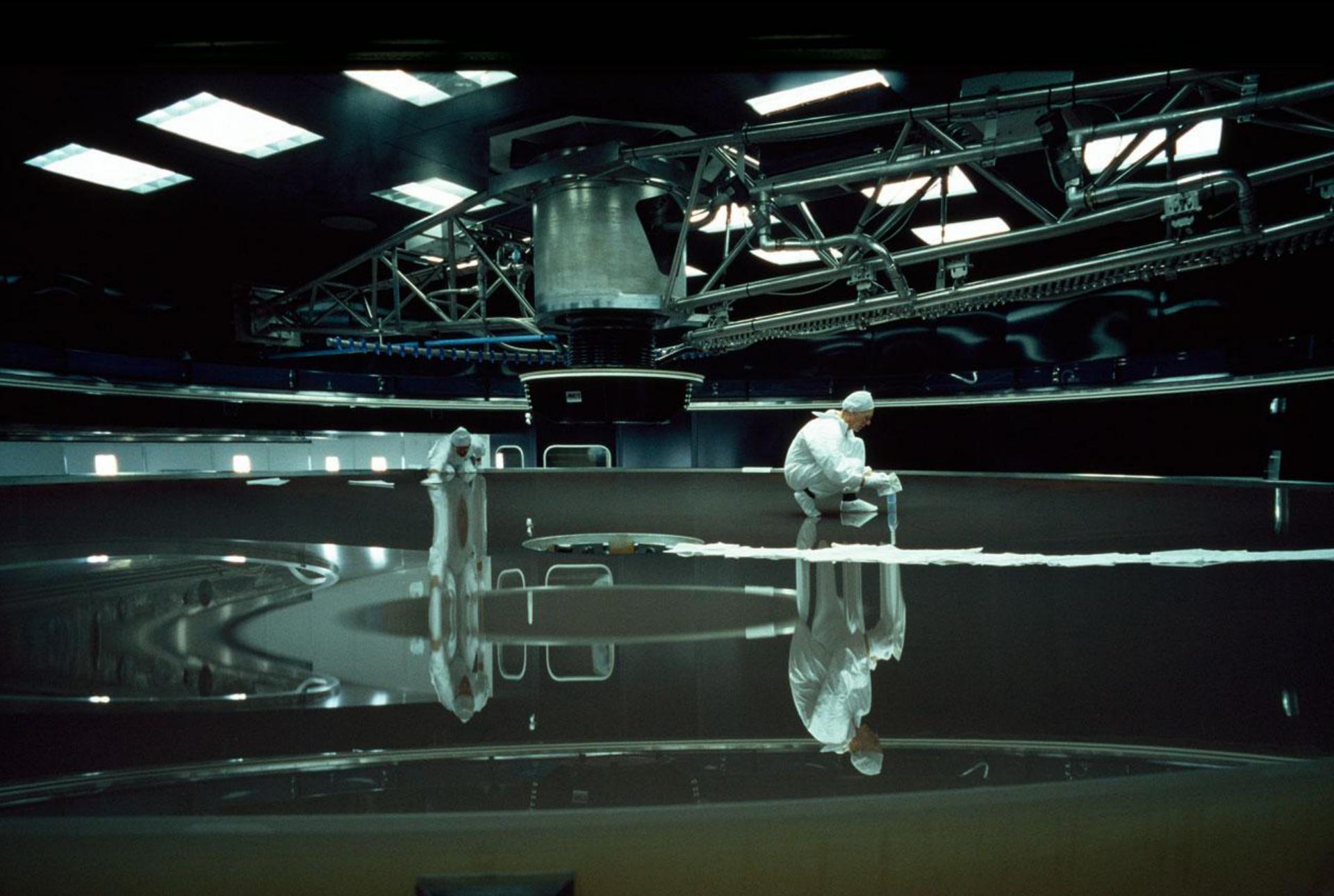
John Hill



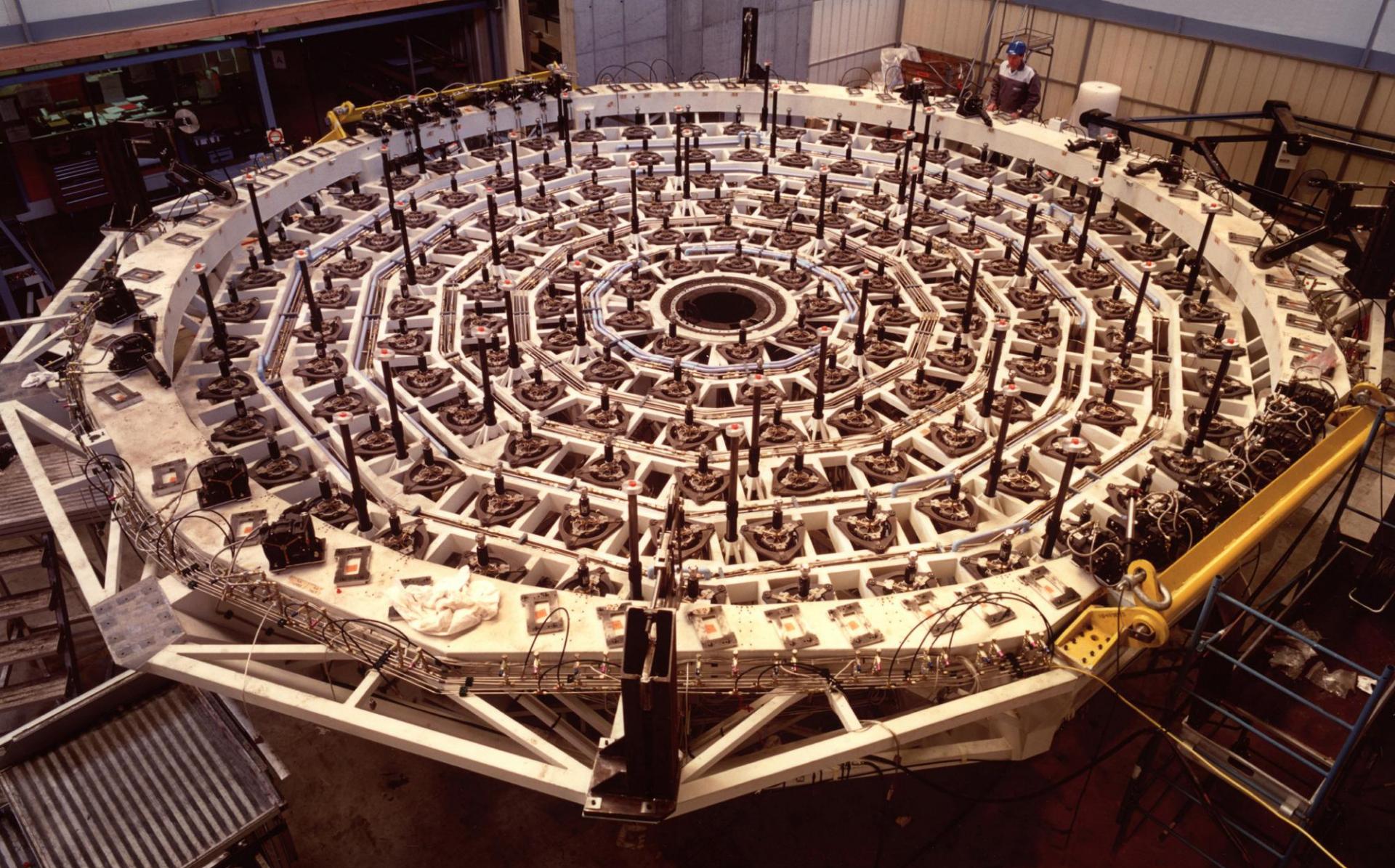
European Southern Observatory



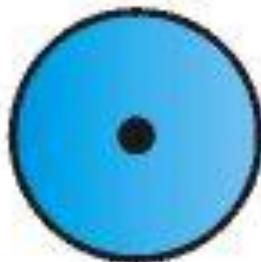
H Raab



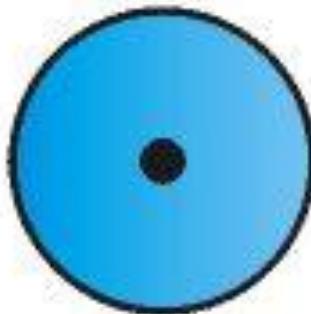
European Southern Observatory



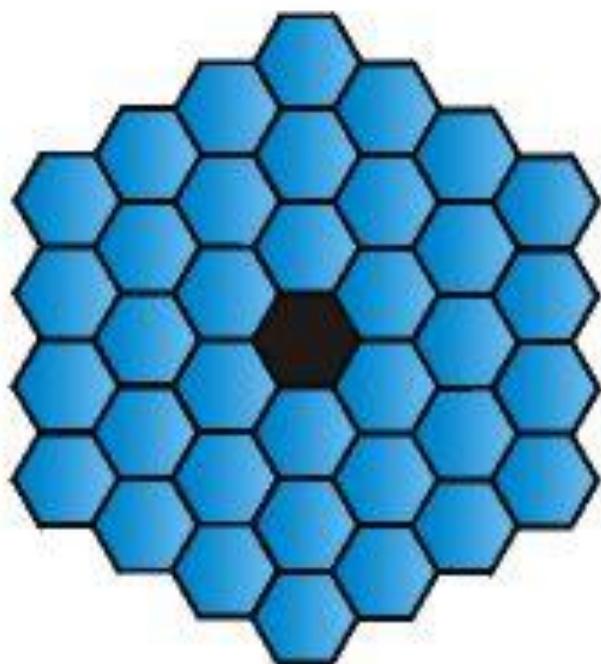
European Southern Observatory



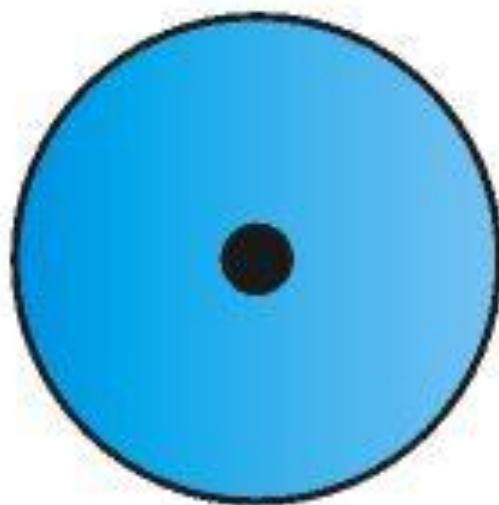
Herschel 4.2m



Palomar 5m

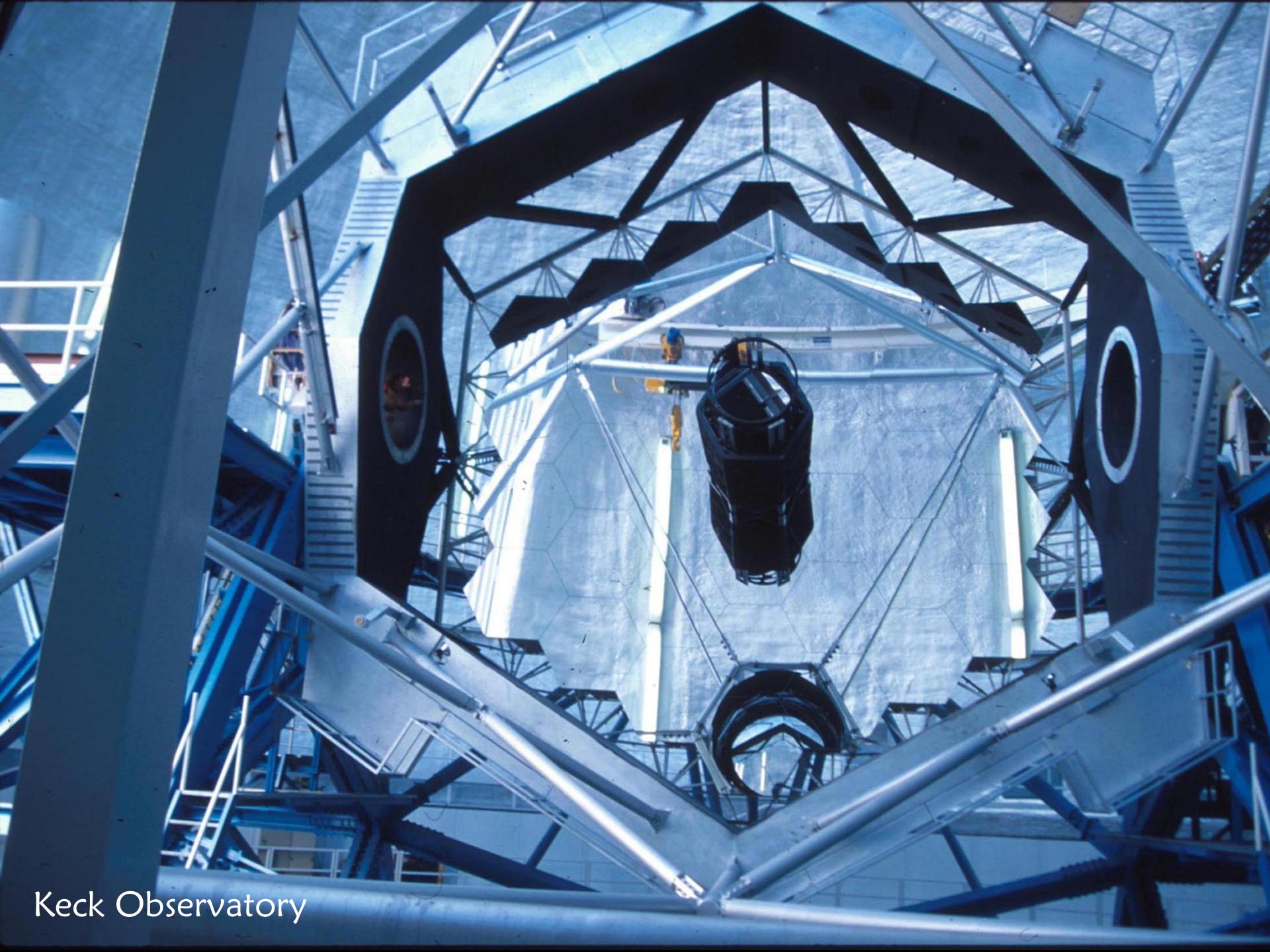


Keck I 10m

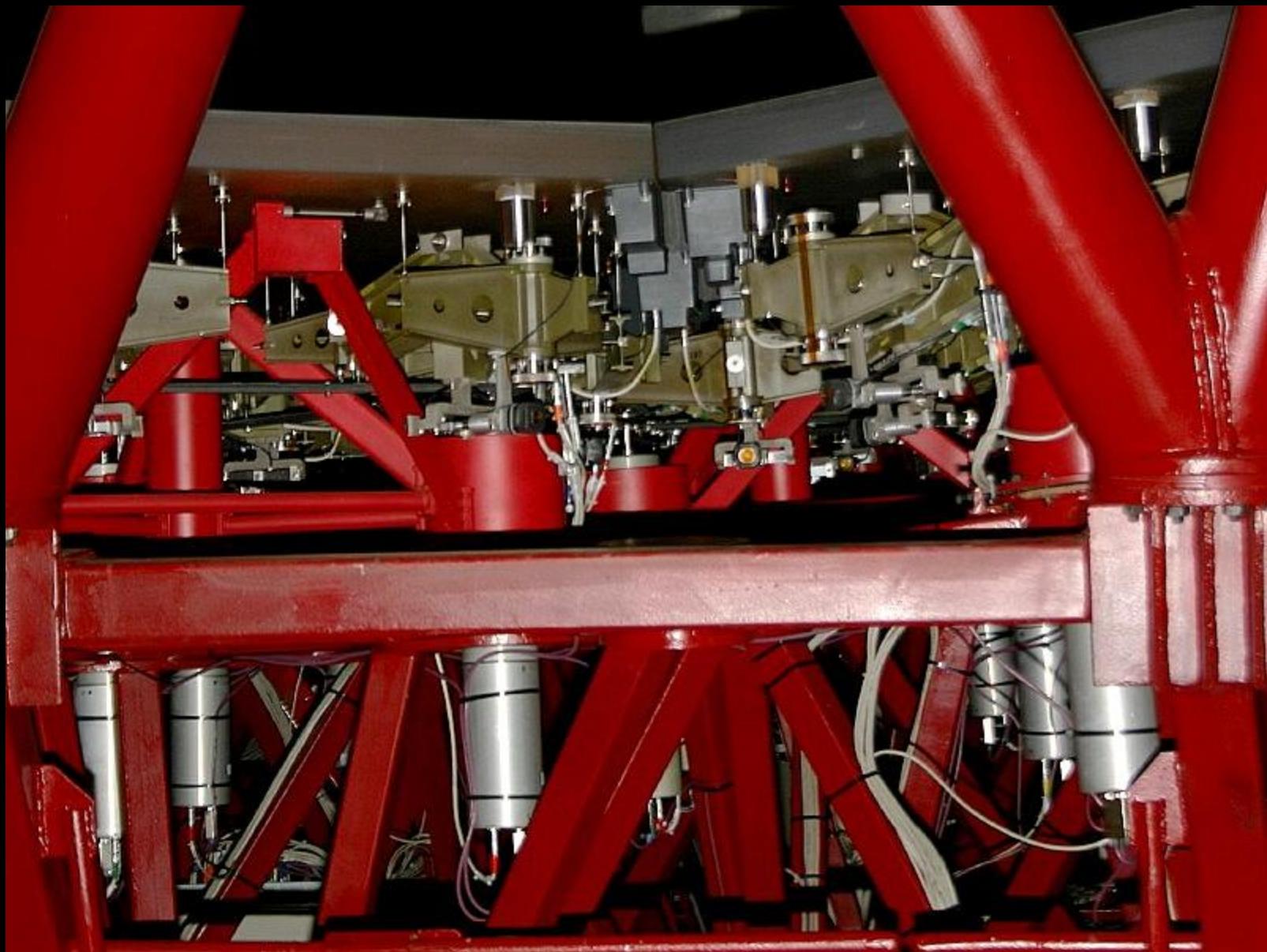


VLT 8.2m

Keck Observatory



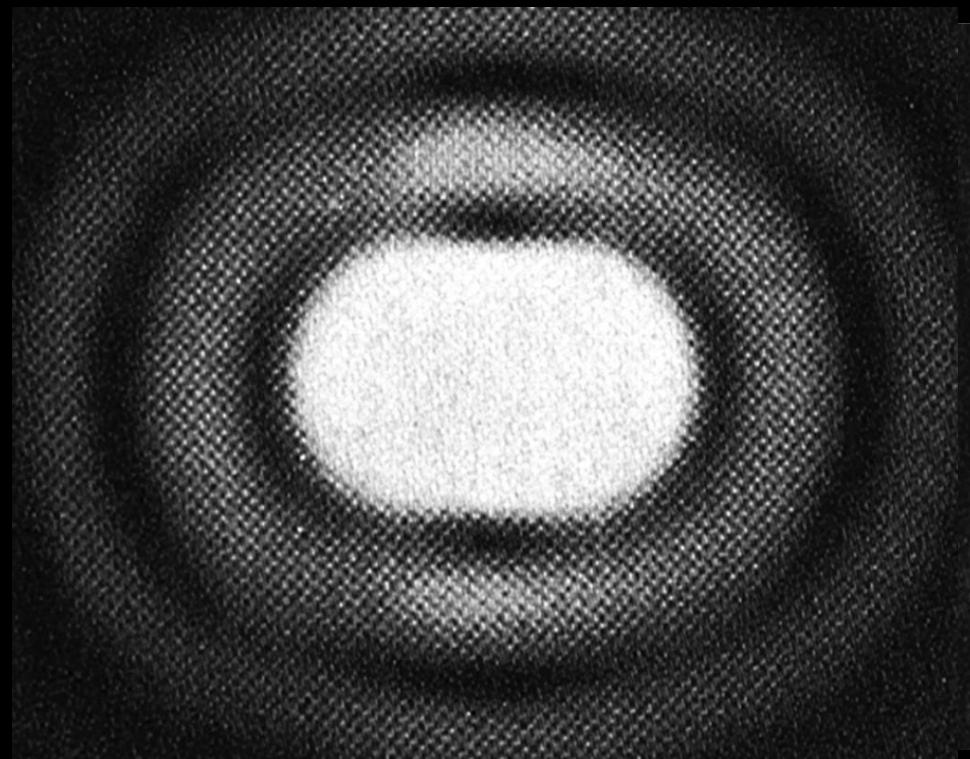
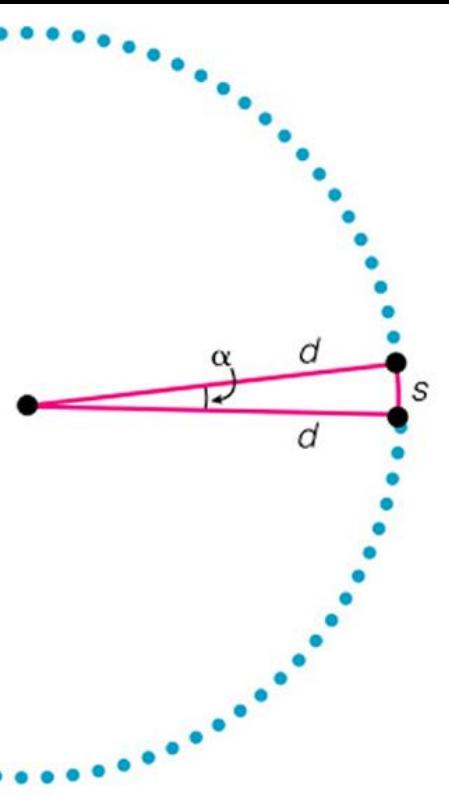
Keck Observatory



H Raab

Diffraction limit

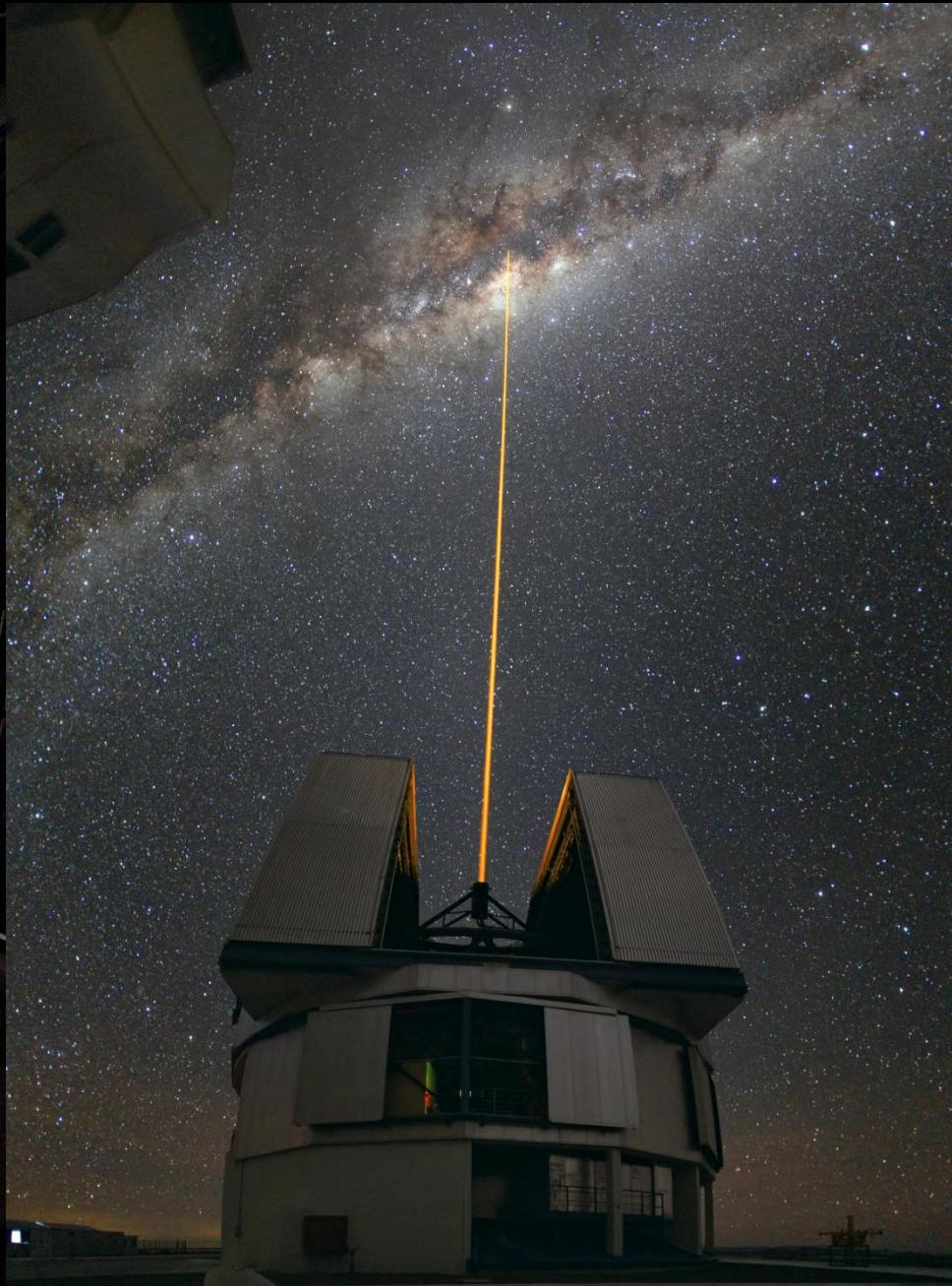
$$\alpha = 2.5 \times 10^5 \frac{\lambda}{D}$$



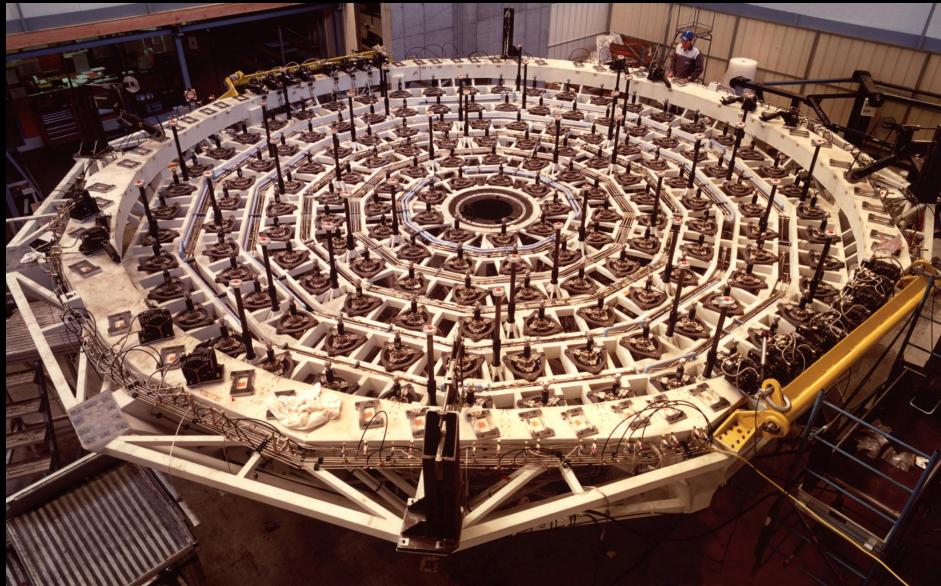
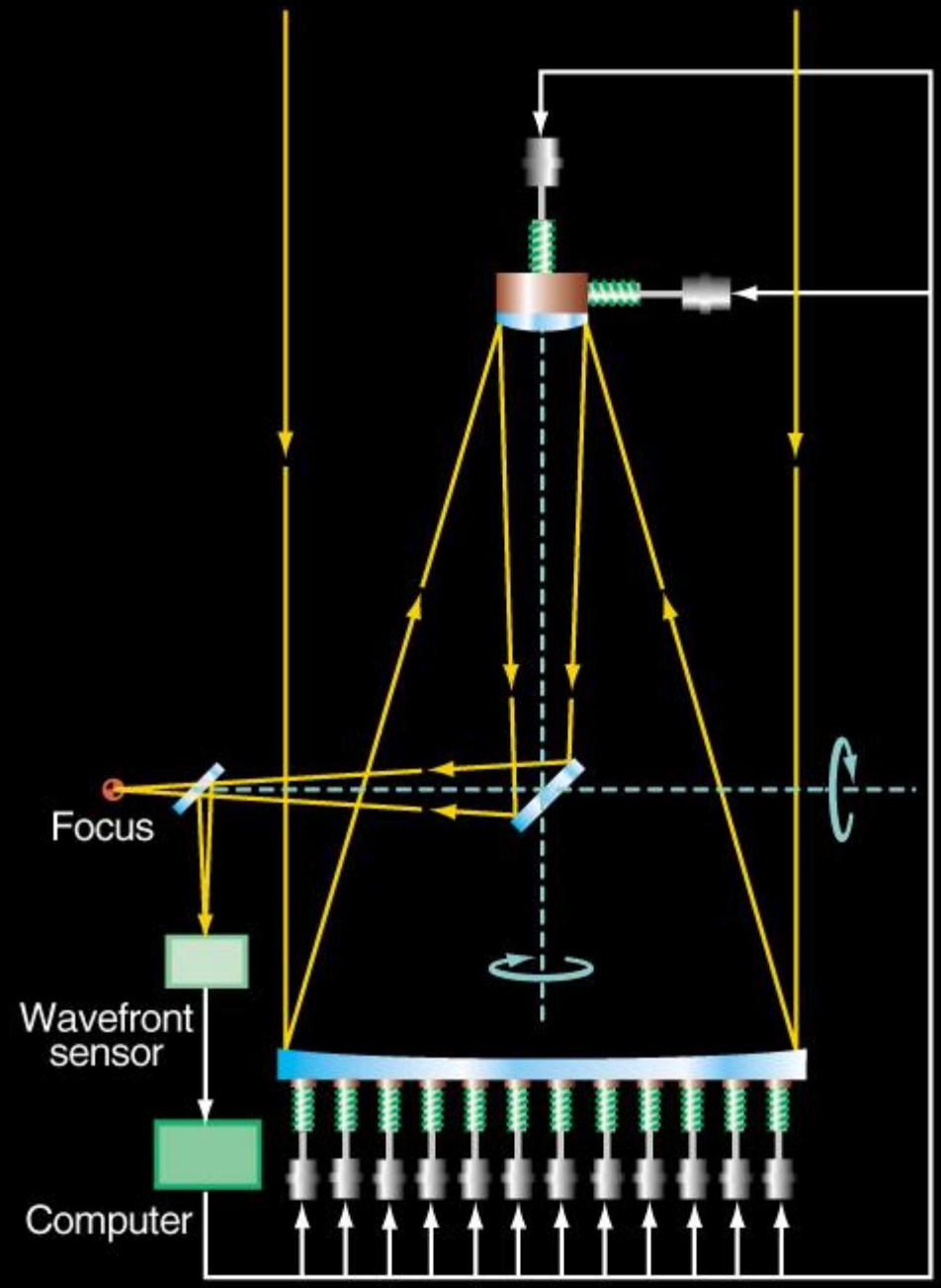




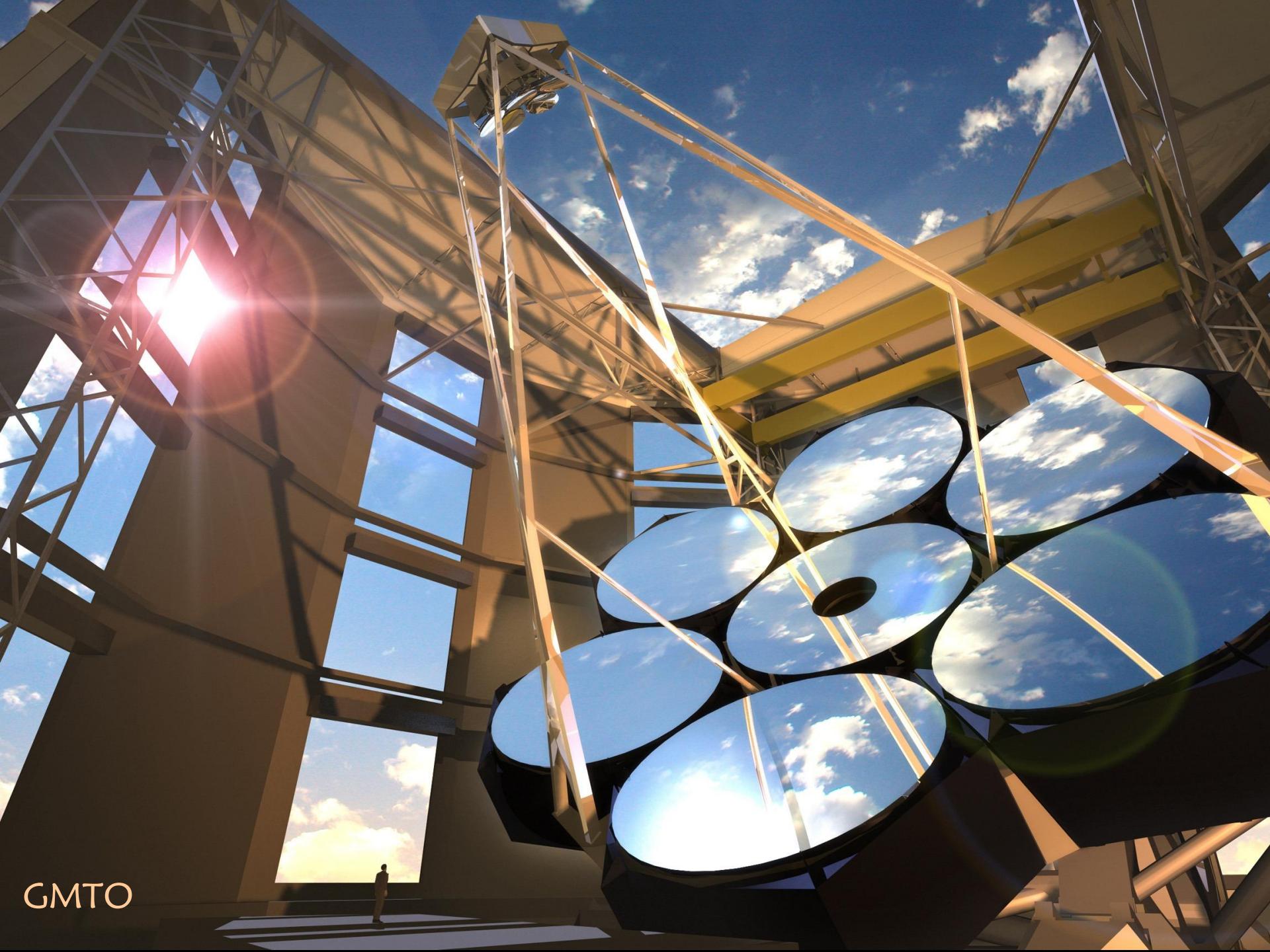
Hudepohl/ European Southern Observatory



Beletsky / European Southern Observatory



European Southern Observatory



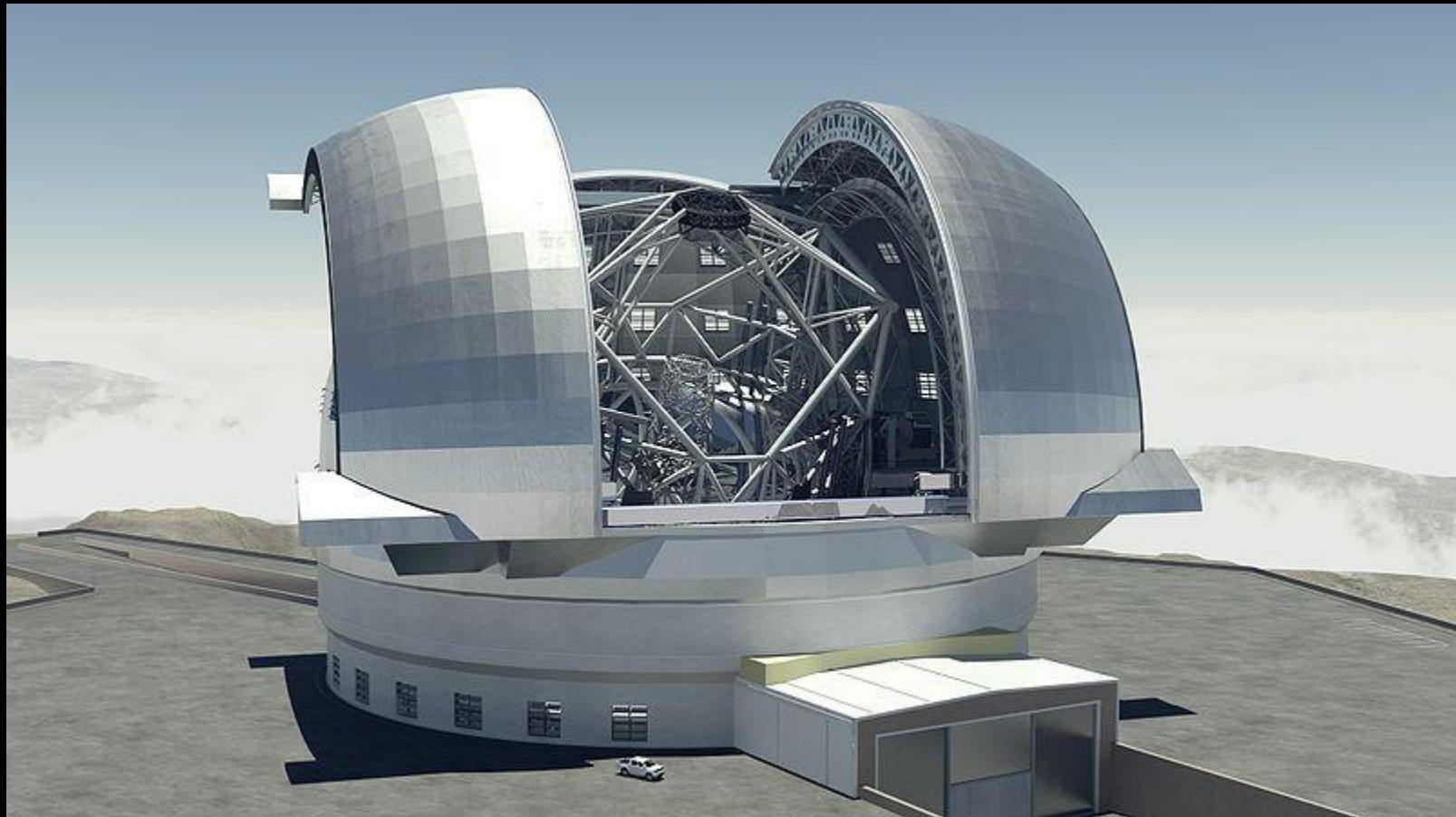
GMT



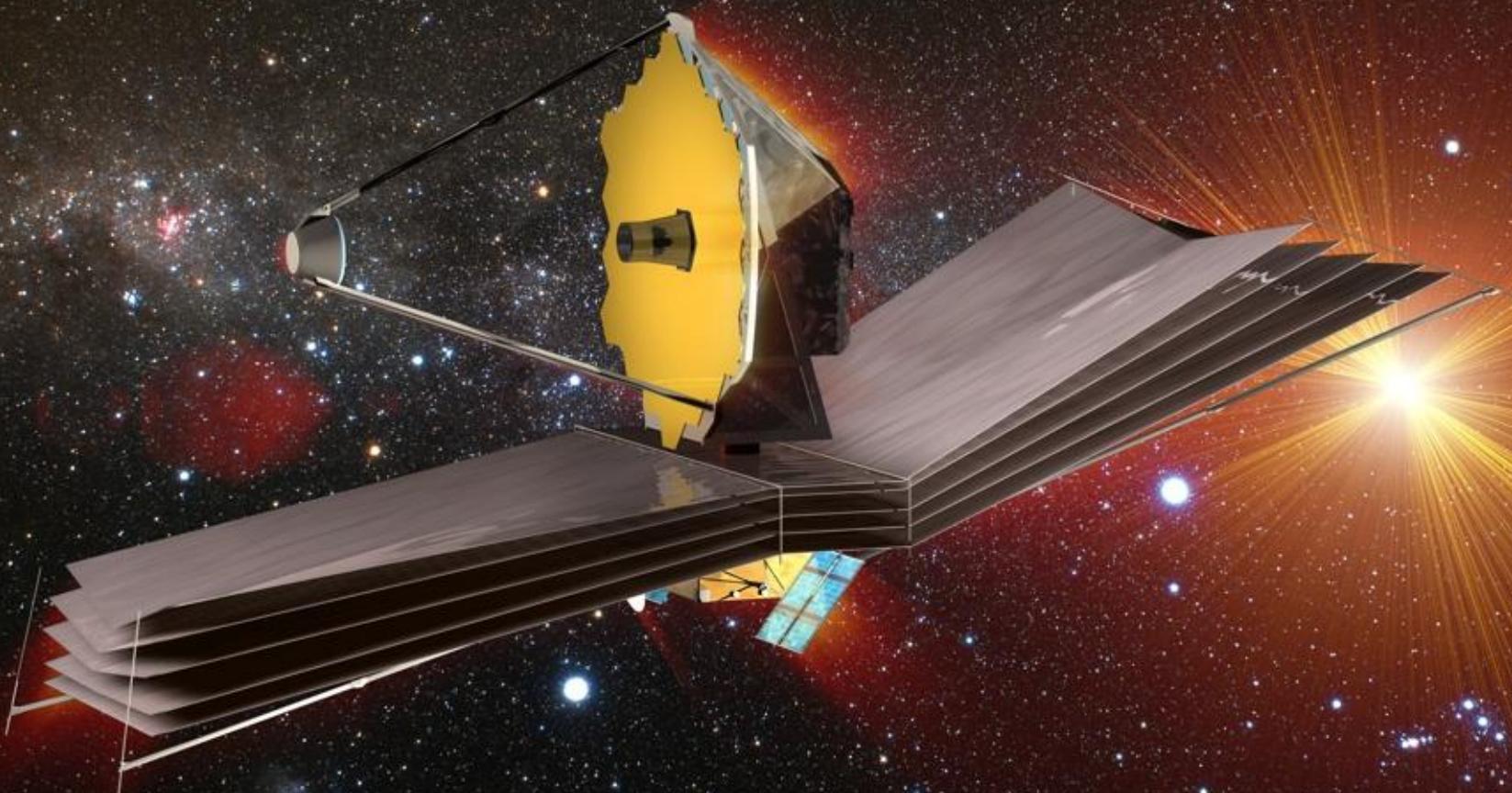
Figueroa / GMTO



TMT



European Southern Observatory



NASA



STAR DUST

WEDNESDAY 13TH JUNE 2012 1PM

John Davis