

1919 EDDINGTON EXPEDITION EQUIPMENT – SOBRAL, BRAZIL

Astrographic telescope used to photograph stars close to the eclipsed Sun

PRINCIPLE OF THE COELOSTAT

The plane mirror reflects sunlight (or starlight) into the fixed telescope. By turning slowly about a vertical axis, the mirror keeps the Sun centred in the field during totality.

16-inch coelostat mirror (plane mirror)



Sun or starlight from sky

Reflected light

Astrographic objective (13-inch, f/6.8)

8-inch stop (where used)

A circular diaphragm at the objective cell reduces the effective aperture to 8 inches for the eclipse exposures.

Focusing (helical) movement

Photographic plate (at focus)

3.43 m focal length

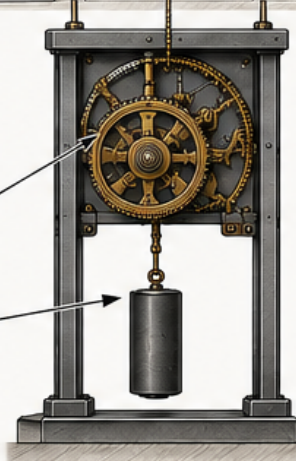
COELOSTAT DRIVE

The mirror is carried on a clock-work drive about a vertical axis. A descending weight provides the power to keep the Sun centred in the field.

Clock mechanism

Driving weight

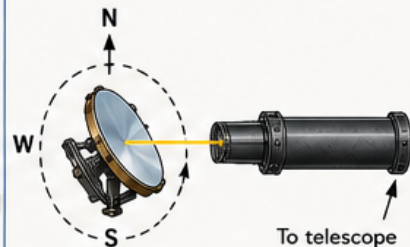
Weight falls slowly and turns the clock.



SIDE ELEVATION (not to scale)

The telescope, objective and plateholder remained fixed. Only the coelostat mirror moved during totality.

PLAN VIEW (from above)



Coelostat mirror rotates slowly (about 1 revolution in ~1 hour 50 min)

The whole instrument was enclosed in a shed with a shutter that could be opened during totality.

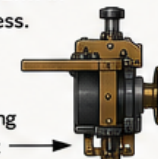
PHOTOGRAPHIC PLATE (at focus)



A glass photographic plate (8¼ × 10¾ inches) held in a light-tight slide.

After the exposure the slide was withdrawn in darkness.

Fine focusing adjustment



SUMMARY OF OPTICAL TRAIN

Sun or starlight
↓
16-inch coelostat mirror (plane)
↓
8-inch stop at objective (where used)
↓
Astrographic objective (13-inch, focal length 3.43 m)
↓
Focus at photographic plate (in telescope focal plane)

NOTES

- Sobral expedition used the 16-inch coelostat built by Grubb.
- A 4-inch coelostat of similar design was used at Principe.
- Totality at both sites lasted about 6 minutes.
- The 8-inch stop reduced spherical aberration and improved definition for the eclipse work.

Sources: A. Crommelin, C. R. Davidson and A. S. Eddington, "Report on the Observations of the Total Eclipse of May 29, 1919," *Phil. Trans. R. Soc. A*, 220 (1920). Diagrams based on descriptions in the report.

Note: Dimensions are approximate. Drawing not to scale.