

Light, from whatever source it comes—whether from the sun, as solar light, or reflected from the planets; from the fixed stars; from putrescent wood; or as the product of the vital activity of glow-worms—always exhibits the same conditions of refraction.* But the prismatic spectra yielded by different sources of light (as the sun and the fixed stars) exhibit a difference in the position of the dark lines (*raies du spectre*) which Wollaston first discovered in 1808, and the position of which was twelve years afterward so accurately determined by Fraunhofer. While the latter observer counted 600 dark lines (breaks or interruptions in the colored spectrum), Sir David Brewster, by his admirable experiments with nitric oxyd, succeeded, in 1833, in counting more than 2000 lines. It had been remarked that certain lines failed in the spectrum at some seasons of the year; but Sir David Brewster has shown that this phenomenon is owing to different altitudes of the sun, and to the different absorption of the rays of light in their passage through the atmosphere. In the spec-

dain, *Sur l'Observatoire de Meragha*, p. 27; and A. Sédillot, *Mém. sur les Instruments Astronomiques des Arabes*, 1841, p. 198. Arabian astronomers have also the merit of having first employed large *gnomons* with small circular apertures. In the colossal sextant of Abu Mohammed al-Chokandi, the limb, which was divided into intervals of five minutes, received the image of the sun. "A midi les rayons du soleil passaient par une ouverture pratique dans la voûte de l'observatoire qui couvrait l'instrument, suivant le tuyau, et formaient sur la concavité du sextant une image circulaire, dont le centre donnait, sur l'arc gradué, le complément de la hauteur du soleil. Cet instrument differe de notre mural, qu'en ce qu'il etait garni d'un simple tuyau au lieu d'une lunette." "At noon, the rays of the sun passed through an opening in the dome of the observatory, above the instrument, and, following the tube, formed in the concavity of the sextant a circular image, the center of which marked the sun's altitude on the graduated limb. This instrument in no way differed from our mural circle, excepting that it was furnished with a mere tube instead of a telescope."—Sédillot, p. 37, 202, 205. Dioptric rulers (*pinnulæ*) were used by the Greeks and Arabs in determining the moon's diameter, and were constructed in such a manner that the circular aperture in the moving object dioptr was larger than that of the fixed ocular dioptr, and was drawn out until the lunar disk, seen through the ocular aperture, completely filled the object aperture.—Delambre, *Hist. de l'Astron. du Moyen Age*, p. 201; and Sédillot, p. 198. The adjustment of the dioptric rulers of Archimedes, with round apertures or slits, in which the direction of the shadows of two small cylinders attached to the same index bar was noted, seems to have been originally introduced by Hipparchus. (Baily, *Hist. de l'Astron. Mod.*, 2d ed., 1785, tom. i., p. 480.) Compare also Theon Alexandrin., Bas., 1538, p. 257, 262; *Les Hypotyp. de Proclus Diadochus*, ed. Halma, 1820, p. 107, 110; and *Ptolem. Almag.*, ed. Halma, tom. i., Par., 1813, p. lvii.

* According to Arago. See Moigno, *Répert. d'Optique Moderne*, 1847, p. 153.