Eclipses were used by Hipparchus for yet other purposes. During a solar eclipse (probably in the year 129 BC), which had been total at the Hellespont, only four-fifths of the sun was obscured at Alexandria. Since the distance between these places, expressed in the earth’s radius, could be computed, Hipparchus was able to derive the parallax of the moon, hence its distance from the earth; he found it variable between 62 and 74 radii of the earth.

![Fig. 10. Shadow Cone of the Earth](image)

Another ingenious method of determining the moon’s parallax was ascribed to him: from the measurement of the size of the earth’s shadow where it is traversed by the moon. From fig. 10, representing the plane section of the shadow cone and the spherical bodies, we can see at once a simple relation of the angles designated by letters. In the triangle moon-earth-sun, angle $a + \text{angle } b = \text{angle } c + \text{angle } d$, or, calling them by their names: parallax of the sun plus parallax of the moon are equal to the sun’s radius plus the semidiameter of the shadow, as seen from the earth. Since the parallax of the sun is very small, the moon’s parallax is found, with a slight error only, by adding the apparent semidiameters of the sun and the shadow.

Hipparchus also is assumed to have made the first catalogue of fixed stars, with their place in the sky expressed by longitude and latitude with respect to the ecliptic. There are reasons to suppose that it formed the main part of the catalogue included by Ptolemy in his own work three centuries later and that it contained nearly 850 stars, to which Ptolemy added another 170. The instrument used to determine the positions is not mentioned; it was probably of the kind later called an ‘armillary sphere’ or ‘armilla’. The Roman author Pliny (c. AD 70) gives as the reason why he undertook this work that Hipparchus ‘discovered a new star, and another one that originated at that time’, and for this reason counted them and determined their positions. This short sentence does not allow us to decide whether during Hipparchus’ life a ‘nova’ really