

METHOD FOR DETERMINING THE LONGITUDE OF PLACES BY OBSERVING OCCULTATIONS OF FIXED STARS BY THE MOON ¹

By Leonhard Euler ²

I. Suppose one has observed the occultation of some fixed star by the moon—for example in Paris—at α hours after noon, and that the right ascension of the moon was determined to be ζ .

II. Suppose in another place west of Paris, one has observed the same occultation at β hours after noon and the right ascension of the moon was determined to be η .

III. At the time of observation in Paris, one may calculate the hourly movement of the moon's right ascension with astronomical tables. Although these tables are not completely accurate, the hourly movement that is found will deviate only a few seconds from the truth. So, let the hourly movement of the right ascension be γ .

IV. Suppose the difference in longitude—which we would like to find—between Paris and the proposed location is z hours. In Paris, it will be $\beta + z$ hours after noon when the right ascension of the moon is η .

V. Recall that in Paris at α hours after noon, the right ascension of the moon was observed to be ζ . Thus, during the time of $\beta + z - \alpha$ hours, the movement of the moon in right ascension was $\eta - \zeta$, which must equal $(\beta + z - \alpha)\gamma$. Consequently, $\beta + z - \alpha = \frac{\eta - \zeta}{\gamma}$ and one finds that the difference in longitude will be $z = \alpha - \beta + \frac{\eta - \zeta}{\gamma}$ hours.

VI. While I have assumed that the unknown location is west of Paris, it is evident that if the value of z is found to be negative, then this location is actually to the east.

VII. If after this conclusion one finds that the longitude of the unknown location is too different from that which had been supposed in the calculation of the moon's parallax in paragraph 6 of the previous article³, it is now possible to correct this calculation, and repeat the same research until the end, in order to find more exactly the longitude sought.

¹Originally published as: “Methode de determiner la longitude des lieux par l’observation d’occultations des étoiles fixes par la lune,” *Mémoires de l’académie royale des sciences et belles-lettres de Berlin* **3** (1747) 1749, pp. 178-179. A copy of the original text is available electronically at the Euler Archive: www.eulerarchive.org. This paper is numbered E115 in the Eneström index.

²Translation by Jennifer Grabowski, Jeffrey Meyer, and Erik Tou of Carthage College.

³This apparently refers to Euler's E114, which appears immediately before this article in the same volume of the Berlin *Mémoires*.