Recherches sur les solutions des principaux problèmes de l'astronomie nautique

Mendoza Rios, Josef de

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Addition.

ADDITION.

Contenant une Méthode pour réduire les Distances lunaires. Par Mr. H. Cavendish, *Membre de la Société Royale*, &c.

Mr. Cavendish m'ayant fait l'honneur de me communiquer la méthode qu'il a trouvé pour réduire les distances lunaires, je profite de la permission de ce savant, pour la faire connoître au public, en plaçant ici un extrait de ce qu'il m'a écrit à ce sujet, dans les propres mots de l'auteur.

Extract of a Letter from Henry Cavendish, *Esq. to Mr.* Mendoza y Rios, *January*, 1795.

" The methods in which the whole distance of the moon and star is computed, particularly yours, require fewer operations than those in which the difference of the true and apparent places is found; but yet, as in the former methods, it is necessary either to take proportional parts, or to use very voluminous tables; I am much inclined to prefer the latter. This induced me to try whether a convenient method of the latter kind might not be deduced from the fundamental proposition used in your paper, and I have obtained the following, which has the advantage of requiring only short tables, and wanting only one proportional part to be taken, and I think seems shorter than any of the kind I have met with.

" Let h and H be the apparent and true altitude of the star;

l and L the apparent and true altitude of the moon, g and G the apparent and true distance of the moon and star. Let the sine and cosine of $g = d$ and δ, the sine and cosine of $l = a$ and α, the sine and cosine of $h = b$ and β; and the sine of the actual and mean horizontal parallax $= p$ and π; and let the sine of $\mathrm{L} = a - m + p\,e$, and its cosine $= \alpha\,(1 + \mu - p\,\varepsilon)$ and let the sine of $\mathrm{H} = b - n$, and its cosine $= \beta\,(1 + \nu)$.

" Then the cosine of $\mathrm{G} = \delta(1 + \mu - p\varepsilon)(1 + \nu) + (a - m + pe)(b - n) - ab\,(1 + \mu - p\,\varepsilon)\,(1 + \nu)$, which equals $\delta + \delta\mu + \delta\nu - \delta p\,\varepsilon + \delta\,\mu\,\nu - \delta p\,\varepsilon\,\nu + ab - bm + bpe - an + n\,m - n\,p\,e - a\,b - \alpha b\,\mu + a\,b\,p\,\varepsilon - a\,b\,\nu - a\,b\,\mu\,\nu + a\,b\,\nu\,p\,\varepsilon = \delta + \delta\,\mu + \delta\,\nu - \delta\,p\,\varepsilon - b\,m - b\,a\,\mu + b\,p\,e + b\,a\,p\varepsilon - a\,n - a\,b\,\nu + n\,m - n\,p\,e - a\,b\,\mu\,\nu + a\,b\,\nu\,p\,\varepsilon + \delta\,\mu\,\nu - \delta\,\pi\,\varepsilon\,\nu$.

" To make use of this rule, it must be considered that the quantity $\delta\,\mu\,\nu - \delta\,p\,\varepsilon\,\nu$ is so small that it may safely be disregarded; but $n\,m - n\,p\,e - a\,b\,\mu\,\nu + a\,b\,\nu\,p\,\varepsilon$, if the altitudes are not more than $5°$, may amount to about $12''$, and therefore ought not to be neglected. The quantity $e + a\,\varepsilon$ also differs very little from one, but is not quite equal to it. Let therefore a table be made under a double argument, namely, the altitudes of the moon and star, giving the value of . . . . $n\,m - n\,\pi\,e - a\,b\,\mu\,\nu + a\,b\,\nu\,\pi\,\varepsilon + b\,\pi\,e + b\,a\,\pi\,\varepsilon - b\,\pi$, answering to different values of these altitudes, which call A. Let a second table be made under a double argument, namely, the altitude of the star and the apparent distance of the moon and star, giving the value of $\delta\,\nu$, which call D. Let a third table be made with the observed altitude for argument, giving the logarithm of $a\,m + a^2\mu$; and let this quantity, answering to the moon's altitude, be called M, and that answering to the star's altitude, N; observing that the same table will do for the moon and star; but a fourth table should be made for the sun, so as to include its parallax; and, lastly, let a fifth table be made, with the moon's altitude for argument, giving the logarithm of $\frac{1}{a} - \frac{\mu}{\pi a}$, which call C. Then will $\cos. G = \delta - \delta a p C - \frac{bM}{a} - \frac{aN}{b} + bp + D - A$.

"It must be observed that $\delta a p C = \delta p \varepsilon - \frac{\delta \mu p}{\pi}$, whereas it ought to equal $\delta p \varepsilon - \delta \mu$; but μ cannot exceed 57″, and the horizontal parallax cannot differ from the mean by more than $\frac{1}{15}$ part of the whole; so that the error arising from thence cannot exceed 3″ or 4″. This small error however may be diminished by giving the quantity C for more than one horizontal parallax."

Addition to the foregoing Letter.

"I have procured tables of the above-mentioned kind to be computed, which are intended to be inserted in a work now printing by Mr. Mendoza y Rios. Allowance is made in them for the alteration of the refractive power of the atmosphere, which is done by two new tables, one giving the correction of the logarithms M and N, and the other the sum of the corrections of $\delta\mu$ and $\delta\nu$. Now it must be observed, that the quantities μ and ν vary only from 57″ to 51″; and therefore the corrections of $\delta\mu$ and $\delta\nu$, may, without any material error, be considered as the same at all altitudes; and therefore the sum of the corrections may be comprehended in a table, under a double argument, namely, the refractive power of the atmosphere and the apparent distance.

"In order to avoid as much as possible the inconvenience arising from using negative quantities, or giving different cases, the table D is continued to 125° of apparent distance, and the numbers in the table A are increased by 0,0003, so as to make them always positive; and to compensate this, the numbers in D are increased by 0,0002, and those in the correction of $\delta\mu + \delta\nu$ by 0,0001. It was found proper also to give the table C for four different values of horizontal parallax.

"The above tables are short, and do not require proportional parts to be taken. The only part of the work in which this is wanted, is in finding the angle answering to the natural cosine of the true distance. In finding the natural cosine of the apparent distance this is avoided, by neglecting the odd seconds in working the problem, and adding them to the result."