

attraction of a homogeneous ellipsoid of revolution become

$$X = -\frac{3hx}{k'^3} \int_0^1 \frac{u^2 du}{\left(1 + \frac{\lambda u^2}{k'^2}\right)^{\frac{3}{2}}},$$

$$Y = -\frac{3hy}{k'^3} \int_0^1 \frac{u^2 du}{\left(1 + \frac{\lambda u^2}{k'^2}\right)^{\frac{3}{2}}},$$

$$Z = -\frac{3hz}{k'^3} \int_0^1 \frac{u^2 du}{1 + \frac{\lambda u^2}{k'^2}},$$

where k' is given by the equation

$$2k'^2 = r^2 - \lambda + \sqrt{(r^2 - \lambda)^2 + 4\lambda z^2}.$$

But Dr. Weiler seems to have put $k' = r$. This cannot be done for the k' which is outside of the sign of integration without losing some part of the attraction which is of the order of the small quantity λ .

Hansen, (*Fundamenta Nova*, pp. 1-16), has elaborated this matter with great generality and much elegance. From this source we learn that the proper expression for the potential function of the action between the earth and moon is

$$W = \frac{\kappa(M+m)}{r} \left[1 + \frac{1}{2} \frac{A+B+C}{Mr^2} - \frac{1}{2} \frac{Ax^2 + By^2 + Cz^2}{Mr^4} \right]$$

where A , B and C are the moments about the axes of x , y and z , supposed to coincide with the principal axes of rotation. In getting this expression, no assumption

respecting the bounding surface or law of interior density of the earth is necessary; it is only assumed that terms of the third and higher orders with respect to the ratio of the dimensions of the earth to the radius-vector of the moon may be neglected.

Very nearly we have $B = A$, and, if this assumption is adopted, W takes the simpler form

$$W = \frac{\kappa(M+m)}{r} \left[1 + \frac{1}{2} \frac{C-A}{Mr^2} \left(1 - 3 \frac{z^2}{r^2} \right) \right].$$

If we put $k = \kappa(M+m)$, and

$$a = \frac{1}{2} \frac{C-A}{Ma_1^2},$$

a will be a constant independent of the linear and time units, and measurements of arcs of the meridian, of the length of the second's pendulum and the data afforded by the phenomena of precession and nutation show that its value is very approximately

$$a = 0.0016395.$$

The expression of the forces, which ought to be substituted for those given by Dr. Weiler, are then

$$X = -\frac{kx}{r^3} \left[1 + a \frac{a_1^2}{r^2} \left(1 - 5 \frac{z^2}{r^2} \right) \right],$$

$$Y = -\frac{ky}{r^3} \left[1 + a \frac{a_1^2}{r^2} \left(1 - 5 \frac{z^2}{r^2} \right) \right],$$

$$Z = -\frac{kz}{r^3} \left[1 + a \frac{a_1^2}{r^2} \left(3 - 5 \frac{z^2}{r^2} \right) \right].$$

Decemb. 24, 1877.

Note on the double Star Σ 547.

By S. W. Burnham.

This pair was discovered by Struve and measured by him three times, the mean result being:

$$P = 344^{\circ}3 \quad D = 4''25 \quad (1831.4).$$

Since these observations, so far as I am aware, this pair has never been seen by any observer. Baron Dembowsky (*A. N.* 1736) could not see the companion in 1865. I examined this and the neighbouring stars carefully with the 6-inch refractor in 1873, 1876, and the early part of 1877 with no better success. Within the last few days I have looked it up with the 18½-inch refractor of the Dearborn Observatory, and found it at once in the place given in *Mensurae Micrometricae*. I have made two sets of measures as follows:

$$P = 8^{\circ}7 \quad D = 2'45 \quad (\text{Dec. 13})$$

$$10.8 \quad 2.47 \quad (\text{Dec. 15}).$$

The magnitudes appeared to be about as noted by Struve, 8.5 and 11.5. My failure to see this on the occasions referred to is still unexplained, as the 6-inch rarely failed to show even the smallest stars in the Dorpat and Pulkowa catalogues. In appearance this is a very insignificant object, but the decided change since the measures of Struve places it at once among pairs worthy of special attention. It is not found in *Positiones Mediae*, but it is Weisse IV. 383, and the place (1880); R. A. 4h19m48s; Decl. — 1°40'.

Chicago, Dec. 18th.