ON QUATERNIONS AND THE DETERMINATION OF THE DISTANCES OF ANY RECENTLY DISCOVERED COMET OR PLANET FROM THE EARTH

By

William Rowan Hamilton

(Proceedings of the Royal Irish Academy, 4 (1850), p. 75.)

Edited by David R. Wilkins

2000

On the Application of Quaternions to the Determination of the Distance of any recently discovered Comet or Planet from the Earth.

By Sir William R. Hamilton.

Communicated February 28th, 1848.

[*Proceedings of the Royal Irish Academy*, vol. 4 (1850), p. 75.]

The following notice was communicated by Sir William Rowan Hamilton, of a Paper "on the Application of Quaternions to the Determination of the Distance of any recently discovered Comet or Planet from the Earth."

This celebrated problem is treated in this paper by means of the formulæ which were communicated to the Academy by the author, in July, 1845. The chief step consists in a very easy deduction, from those formulæ, of the equation:

$$\frac{a}{c}\left(\frac{M}{a^3}-\frac{M}{b^3}\right)=\frac{\mathrm{S}\,.\,\gamma\gamma'\gamma''}{\mathrm{S}\,.\,\gamma\gamma'\alpha};$$

where c is the sought distance of the comet (or planet) from the earth; M is the mass of the sun, and a and b are the distances of earth and comet from that body; α is the heliocentric vector-unit of the earth, and γ is the geocentric vector-unit of the comet; while γ', γ'' are the first and second differential coefficients of γ, taken with respect to the time, and determined, along with γ itself, from three successive observations: and S is the characteristic of the operation of taking the scalar part of a quaternion. The second member of the equation admits of being geometrically interpreted as a ratio of two pyramids, and can in various ways be transformed by the rules of the calculus of quaternions.