http://www.geology.19thcenturyscience.org/books/1858-Whewell-HistSci/README.htm

ity was greatest also." He then adds some further remarks on the circumstances according to which the moon's place, as affected by this new inequality, is before or behind the place, as given by the epicyclical hypothesis.

Such is the announcement of the celebrated discovery of the moon's second inequality, afterwards called (by Bullialdus) the *Evection.* Ptolemy soon proceeded to represent this inequality by a combination of circular motions, uniting, for this purpose, the hypothesis of an epicycle, already employed to explain the first inequality, with the hypothesis of an eccentric, in the circumference of which the centre of the epicycle was supposed to move. The mode of combining these was somewhat complex; more complex we may, perhaps, say, than was absolutely requisite;[33] the apogee of the eccentric moved backwards, or contrary to the order of the signs, and the centre of the epicycle moved forwards nearly twice as fast upon the circumference of the eccentric, so as to reach a place nearly, but not exactly, the same, as if it had moved in a concentric instead of an eccentric path. Thus the centre of the epicycle went twice round the eccentric in the course of one month: and in this manner it satisfied the condition that it should vanish at new and full moon, and be greatest when the moon was in the quarters of her monthly course.[34]

The discovery of the Evection, and the reduction of it to the epi-

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[33] If Ptolemy had used the hypothesis of an eccentric instead of an epicycle for the first inequality of the moon, an epicycle would have represented the second inequality more simply than his method did.

[34] I will insert here the explanation which my German translator, the late distinguished astronomer Littrow, has given of this point. The Rule of this Inequality, the Evection, may be most simply expressed thus. If a denote the excess of the Moon's Longitude over the Sun's, and b the Anomaly of the Moon reckoned from her Perigee, the Evection is equal to $1^\circ. 3 . \sin (2a-b)$. At New and Full Moon, a is 0 or 180°, and thus the Evection is $-1^\circ. 3 . \sin b$. At both quarters, or dichotomies, a is 90° or 270°, and consequently the Evection is $+ 1^\circ. 3 . \sin b$. The Moon's Elliptical Equation of the centre is at all points of her orbit equal to $6^\circ. 3 . \sin b$. The Greek Astronomers before Ptolemy observed the moon only at the time of eclipses; and hence they necessarily found for the sum of these two greatest inequalities of the moon's motion the quantity $6^\circ . 3 . \sin b - 1^\circ . 3 . \sin b$, or $5^\circ . \sin b$: and as they took this for the moon's equation of the centre, which depends upon the eccentricity of the moon's orbit, we obtain from this too small equation of the centre, an eccentricity also smaller than the truth. Ptolemy, who first observed the moon in her quarters, found for the sum of those Inequalities at those points the quantity $6^\circ . 3 . \sin b + 1^\circ . 3 . \sin b$, or $7^\circ . 6 . \sin b$; and thus made the eccentricity of the moon as much too great at the quarters as the observers of eclipses had made it too small. He hence concluded that the eccentricity of the Moon's orbit is variable, which is not the case.