

the inequality of the *motions* of the moon, would, in fact, double the inequality of the *distances*. The Eccentricity of the moon's orbit is determined by Ptolemy as $\frac{1}{12}$ of the radius of the orbit; but its real amount is only half as great; this difference is a necessary consequence of the supposition of uniform circular motions, on which the Epicyclic Hypothesis proceeds.

We see, therefore, that this part of the Hipparchian theory carries in itself the germ of its own destruction. As soon as the art of celestial measurement was so far perfected, that astronomers could be sure of the apparent diameter of the moon within $\frac{1}{30}$ or $\frac{1}{40}$ of the whole, the inconsistency of the theory with itself would become manifest. We shall see, hereafter, the way in which this inconsistency operated; in reality a very long period elapsed before the methods of observing were sufficiently good to bring it clearly into view.

Sect. 3.—Methods of Observation of the Greek Astronomers.

WE must now say a word concerning the Methods above spoken of. Since one of the most important tasks of verification is to ascertain with accuracy the magnitude of the quantities which enter, as elements, into the theory which occupies men during the period; the improvement of instruments, and the methods of observing and experimenting, are principal features in such periods. We shall, therefore, mention some of the facts which bear upon this point.

The estimation of distances among the stars by the eye, is an extremely inexact process. In some of the ancient observations, however, this appears to have been the method employed; and stars are described as being *a cubit* or *two cubits* from other stars. We may form some notion of the scale of this kind of measurement, from what Cleomedes remarks,⁴ that the sun appears to be about a foot broad; an opinion which he confutes at length.

A method of determining the positions of the stars, susceptible of a little more exactness than the former, is the use of *alignations*, already noticed in speaking of Hipparchus's catalogue. Thus, a straight line passing through two stars of the Great Bear passes also through the pole-star; this is, indeed, even now a method usually employed to enable us readily to fix on the pole-star; and the two stars β and α of Ursa Major, are hence often called "the pointers."

⁴ Del. A. A. i. 222.