

But nothing like accurate measurements of any portions of the sky were obtained, till astronomers adopted the method of making visual coincidences of the objects with the instruments, either by means of *shadows* or of *sights*.

Probably the oldest and most obvious measurements of the positions of the heavenly bodies were those in which the elevation of the sun was determined by comparing the length of the shadow of an upright staff or *gnomon*, with the length of the staff itself. It appears,<sup>5</sup> from a memoir of Gaultil, first printed in the *Connaissance des Temps* for 1809, that, at the lower town of Loyang, now called Hon-anfou, Tchou-kong found the length of the shadow of the gnomon, at the summer solstice, equal to one foot and a half, the gnomon itself being eight feet in length. This was about 1100 B. C. The Greeks, at an early period, used the same method. Strabo says<sup>6</sup> that "Byzantium and Marseilles are on the same parallel of latitude, because the shadows at those places have the same proportion to the gnomon, according to the statement of Hipparchus, who follows Pytheas."

But the relations of position which astronomy considers, are, for the most part, angular distances; and these are most simply expressed by the intercepted portion of a circumference described about the angular point. The use of the gnomon might lead to the determination of the angle by the graphical methods of geometry; but the numerical expression of the circumference required some progress in trigonometry; for instance, a table of the tangents of angles.

Instruments were soon invented for measuring angles, by means of circles, which had a border or *limb*, divided into equal parts. The whole circumference was divided into 360 *degrees*: perhaps because the circles, first so divided, were those which represented the sun's annual path; one such degree would be the sun's daily advance, more nearly than any other convenient aliquot part which could be taken. The position of the sun was determined by means of the shadow of one part of the instrument upon the other. The most ancient instrument of this kind appears to be the *Hemisphere of Berosus*. A hollow hemisphere was placed with its rim horizontal, and a style was erected in such a manner that the extremity of the style was exactly at the centre of the sphere. The shadow of this extremity, on the concave surface, had the same position with regard to the lowest point of the sphere which the sun had with regard to the highest point of the heavens.

<sup>5</sup> Lib. U. K. *Hist. Ast.* p. 5.

<sup>6</sup> Del. *A. A.* i. 257.