

The perfection in the graduation of the arc would have failed entirely, or to a considerable extent, in affording that greater precision of observation at which it aimed, if optical and astronomical instruments had not been brought into accord, and the correctness of vision made to correspond with that of measurement. The micrometer-application of fine threads stretched in the focus of the telescope, to which that instrument owes its real and invaluable importance, was first devised, six years afterward (1640), by the young and talented Gascoigne.*

While, as I have already observed, telescopic vision, observation, and measurement extend only over a period of about 240 years in the history of astronomical science, we find, without including the epoch of the Chaldeans, Egyptians, and Chinese, that more than nineteen centuries have intervened between the age of Timochares and Aristillus† and the discoveries of Galileo, during which period the position and course of the stars were observed by the eye alone, unaided by instruments. When we consider the numerous disturbances which, during this prolonged period, checked the advance of civilization, and the extension of the sphere of ideas among the nations inhabiting the basin of the Mediterranean, we are astonished that Hipparchus and Ptolemy should have been so well acquainted with the precession of the equinoxes, the complicated movements of the planets, the two principal inequalities of the moon, and the position of the stars; that Copernicus should have had so great a knowledge of the true system of the universe; and that Tycho Brahe should have been so familiar with the methods of practical astronomy before the discovery of the telescope. Long tubes,

272. Morin, in his work, *Scientia Longitudinum*, which appeared in 1634, writes as follows: *Applicatio tubi optici ad alhidadam pro stellis fixis prompte et accurate mensurandis a me excogitata est.* Picard had not, up to the year 1667, employed any telescope on the mural circle; and Hevelius, when Halley visited him at Dantzic in 1679, and admired the precision of his measurement of altitudes, was observing through improved slits or openings. (Baily's *Catal. of Stars*, p. 38.)

* The unfortunate Gascoigne, whose merits remained so long unacknowledged, lost his life, when scarcely twenty-three years of age, at the battle of Marston Moor, fought by Cromwell against the Royalists. See Derham, in the *Philos. Transact.*, vol. xxx., for 1717-1719, p. 603-610. To him belongs the merit of a discovery which was long ascribed to Picard and Auzout, and which has given an impulse previously unknown to practical astronomy, the principal object of which is to determine positions in the vault of heaven.

† *Cosmos*, vol. ii., p. 177, 178.