

the laborious observations of the Landgrave William IV. at Cassel. Tycho Brahe's catalogue, as revised and published by Kepler, contains no more than 1000 stars, of which one fourth at most belong to the sixth magnitude. This catalogue, and that of Hevelius, which was less frequently employed, and contained 1564 determinations of position for the year 1660, were the last which were made by the unaided eye, owing their compilation in this manner to the capricious disinclination of the Dantzic astronomer to apply the telescope to purposes of measurement.

This combination of the telescope with measuring instruments—the union of telescopic vision and measurements—at length enabled astronomers to determine the position of stars below the sixth magnitude, and more especially between the seventh and the twelfth. The region of the fixed stars might now, for the first time, be said to be brought within the reach of observers. Enumerations of the fainter telescopic stars, and determinations of their position, have not only yielded the advantage of making a larger portion of the regions of space known to us by the extension of the sphere of observation, but they have also (what is still more important) indirectly exercised an essential influence on our knowledge of the structure and configuration of the universe, on the discovery of new planets, and on the more rapid determination of their orbits. When William Herschel conceived the happy idea of, as it were, casting a sounding line in the depths of space, and of counting during his gaugings the stars which passed through the field of his great telescope,* at different distances from the Milky Way, the law was discovered that the number of stars increased in proportion to their vicinity to the Milky Way—a law which gave rise to the idea of the existence of large concentric rings filled with millions of stars which constitute the many-cleft Galaxy. The knowledge of the number and the relative position of the faintest stars facilitates (as was proved by Galle's rapid and felicitous discovery of Neptune, and by that of several of the smaller planets) the recognition of planetary cosmical bodies which change their positions, moving, as it were, between fixed boundaries. Another circumstance proves even more distinctly the importance of very complete catalogues of the stars. If a new planet be once discovered in the vault of heaven, its notification in an older catalogue of po-

* *Cosmos*, vol. i., p. 87-89.