

the *Novum Organon*. The invention of the telescope, and the greatest discoveries in physical astronomy (viz., Jupiter's satellites, the sun's spots, the phases of Venus, and the remarkable form of Saturn), fall between the years 1609 and 1612. Kepler's speculations on the elliptic orbit of Mars* were begun in 1601, and gave occasion, eight years after, to the completion of the work entitled *Astronomia nova seu Physica celestis*. "By the study of the orbit of Mars," writes Kepler, "we must either arrive at a knowledge of the secrets of astronomy, or forever remain ignorant of them. I have succeeded, by untiring and continued labor, in subjecting the inequalities of the movement of Mars to a natural law." The generalization of the same idea led the highly-gifted mind of Kepler to the great cosmical truths and presentiments which, ten years later, he published in his work entitled *Harmonices Mundi libri quinque*. "I believe," he well observes in a letter to the Danish astronomer Longomontanus, "that astronomy and physics are so intimately associated together, that neither can be perfected without the other." The results of his researches on the structure of the eye and the theory of vision appeared in 1604 in the *Paralipomena ad Vitellionem*, and in 1611† in the *Dioptrica*. Thus were the knowledge of the most important objects in the perceptive world and in the regions of space, and the mode of apprehending these objects by means of new discoveries, alike rapidly increased in the short period of the first ten or twelve years of a century which began with Galileo and Kepler, and closed with Newton and Leibnitz.

The accidental discovery of the power of the telescope to penetrate through space originated in Holland, probably in the closing part of the year 1608. From the most recent investigations it would appear that this great discovery may be claimed by Hans Lippershey, a native of Wesel and a spectacle maker at Middleburg; by Jacob Adriaansz, surnamed Metius, who is said also to have made burning glasses of ice; and by Zacharias Jansen.‡ The first-named is always called

* Delambre, *Hist. de l'Astronomie Ancienne*, t. ii., p. 381.

† See Sir David Brewster's judgment on Kepler's optical works, in the "*Martyrs of Science*," 1846, p. 179-182. (Compare Wilde, *Gesch. der Optik*, 1838, th. i., s. 182-210.) If the law of the refraction of the rays of light belong to Willebrord Snellius, professor at Leyden (1626), who left it behind him buried in his papers, the publication of the law in a trigonometrical form was, on the other hand, first made by Descartes. See Brewster, in the *North British Review*, vol. vii., p. 207; Wilde, *Gesch. der Optik*, th. i., s. 227.

‡ Compare two excellent treatises on the discovery of the telescope, by Professor Moll, of Utrecht, in the *Journal of the Royal Institution*,