

couraged Kepler to extend his hypothesis even so far as the region of fixed stars.* The circumstance which, on the occasion of the discovery of Ceres, and the other so-called *small planets*, first forcibly recalled to mind Kepler's Pythagorean arguments, was his almost forgotten conjecture as to the probable existence of a yet unseen planet in the great planetless chasm between Mars and Jupiter. ("Motus semper distantiam pone sequi videtur; atque ubi magnus hiatus erat inter orbes, erat et inter motus."†) "I have become more daring," he says, in the introduction to the *Mysterium Cosmographicum*, "and place a new planet between Jupiter and Mars, as also (a conjecture which was less fortunate, and remained long unnoticed‡) another planet between Venus and Mercury; neither of these have been seen, probably on account of their extreme smallness.§ Kepler subsequently found that

* Tycho had denied the existence of the crystalline spheres, in which the planets were supposed to be fixed. Kepler praised the undertaking, but he still adhered to the opinion that the sphere of fixed stars was a solid globular shell of two German miles in thickness, upon which are the twelve fixed stars, which are all situated at equal distances from us, and have a peculiar relation to the corners of an icosahedron. The fixed stars "lumina sua ab intus emittunt;" "emit light from their own bodies;" he also considered for a long time that the planets were self-luminous, until Galileo taught him better! Although he, like many other of the ancients and Giordano Bruno, considered the fixed stars to be suns like our own, still he was not much inclined to entertain the opinion, which he had well considered, that all fixed stars are surrounded by planets, as I had formerly stated them to be. (*Cosmos*, vol. ii., p. 328.) Compare Apelt, *Commentary to the Harmonice*, p. 21-24.

† ["There seems to be always a close relation between the motion and the distance [of the planets]; that is to say, where there is a great interval between their orbs, the same exists also between their motions."]

‡ It was not until the year 1821 that Delambre, in the *Hist. de l'Astron. Mod.*, tom. i., p. 314, directed attention to the planets which Kepler conjectured to lie between Mercury and Venus, in the extracts which are complete with regard to astronomy, but not with regard to astrology, from Kepler's collected works (p. 314-615). "On n'a fait aucune attention à cette supposition de Kepler, quand on a formé des projets de découvrir la planète qui (selon une autre de ces prédictions) devait circuler entre Mars et Jupiter." "No attention was paid to that supposition of Kepler's when projects were formed for discovering the planet, which (according to another of his predictions) ought to revolve between Mars and Jupiter."

§ The remarkable passage respecting a space to be filled up between Mars and Jupiter [hiatus] is in Kepler's *Prodromus Dissertationum Cosmographicarum, continens Mysterium Cosmographicum de admirabili proportione Orbium Cælestium*, 1596, p. 7: "Cum igitur hac non succederet, alia via, mirum quam audaci, tentavi aditum. Inter Jovem et Martem interposui novum planetam, itemque alium inter Venerem et