

ets. The differences of density which are presented by Mars, Venus, the Earth, and even Mercury, are very slight; almost equally similar among each other, but from 4 to 7 times less dense than the former group, are the planets more distant from the Sun—Jupiter, Neptune, Uranus, and Saturn. The density of the Sun (0.252, if the Earth is taken as 1.000; therefore, in reference to water, 1.37) is but little more than the densities of Jupiter and Neptune. Consequently, the planets and the Sun\* must be arranged, according to their increasing density, in the following order:

Saturn, Uranus, Neptune, Jupiter, Sun, Venus, Mars, Earth, Mercury.

Although, upon the whole, the densest planets are nearer to the Sun, still, *when they are considered individually*, their density is by no means proportional to the distances, as Newton was inclined to assume.†

7. *Periods of Sidereal Revolution and Axial Rotation.*—We shall confine ourselves here to giving the sidereal, or true periods of revolution of the planets in reference to the fixed stars, or a fixed point of the heavens. During such a revolution, a planet passes through exactly 360 degrees in its course round the Sun. The sidereal revolutions of the planets must be clearly distinguished from the tropical and synodic, the former of which refer to the return to the spring equinox, the latter to the difference of time between two consecutive conjunctions or oppositions.

\* The Sun (which Kepler considered to be magnetic, probably from enthusiastic admiration for the *divina inventa* of his justly famous contemporary, William Gilbert, and whose rotation in the same direction as the planets he maintained long before the Sun-spots were discovered) Kepler declares, in his *Comment. de motibus Stellæ Martis* (cap. 23), and in *Astronomiæ pars Optica* (cap. 6), to be “the densest of all cosmical bodies, because it moves all the others which belong to his system.”

† Newton, *De Mundi Systemate*, in *Opusculis*, tom. ii., p. 17: “Corpora Veneris et Mercurii majore Solis calore magis concocta et coagulata sunt. Planetæ posteriores, defectu caloris, carent substantiis illis metallicis et mineris ponderosis quibus Terra referta est. Densiora corpora quæ Soli propiora: ea ratione constabit optime pondera Planetarum omnium esse inter se ut vires.” “The bodies of Venus and Mercury are more ripened and condensed on account of the greater heat of the Sun. The more remote planets, by want of heat, are deficient in those metallic substances and weighty minerals with which the Earth abounds. Bodies are denser in proportion to their nearness to the Sun; from which reason it will easily appear that the weight of all planets is in proportion to their forces.”