

Such general considerations regarding certain characteristic properties appertaining to whole groups, can not, however, be applied with equal justice to the individual planets of every group, nor to the relations between the distances of the revolving planets from the central body, and their absolute size, density, period of rotation, eccentricity, and the inclination of their orbits and the axes. We know as yet of no inherent necessity, no mechanical natural law, similar to the one which teaches us that the squares of the periodic times are proportional to the cubes of the major axes, by which the above-named six elements of the planetary bodies and the form of their orbit are made dependent either on one another, or on their mean distance from the Sun. Mars is smaller than the Earth and Venus, although further removed from the Sun than these last-named planets, approaching most nearly in size to Mercury, the nearest planet to the Sun. Saturn is smaller than Jupiter, and yet much larger than Uranus. The zone of the telescopic planets, which have so inconsiderable a volume, immediately precede Jupiter (the greatest in size of any of the planetary bodies), if we consider them with regard to distance from the Sun; and yet the disks of these small asteroids, which scarcely admit of measurement, have an areal surface not much more than half that of France, Madagascar, or Borneo. However striking may be the extremely small density of all the colossal planets, which are furthest removed from the Sun, we are yet unable in this respect to recognize any regular succession.* Uranus appears to be denser than Saturn, even if we adopt the smaller mass, $\frac{1}{24} \frac{1}{105}$, assumed by Lamont; and, notwithstanding the inconsiderable difference of density observed in the innermost planetary group,† we find both Venus and Mars less dense than the Earth, which lies between them. The time of rotation certainly diminishes with increasing solar distance, but yet it is greater in Mars than in the Earth, and in Saturn than in Jupiter. The el-

* See Kepler, on the increasing density and volume of the planets in proportion with their increase of distance from the Sun, which is described as the densest of all the heavenly bodies; in the *Epitome Astron. Copern. in vii. libros digesta*, 1618-1622, p. 420. Leibnitz also inclined to the opinions of Kepler and Otto von Guericke, that the planets increase in volume in proportion to their increase of distance from the Sun. See his letter to the Magdeburg Burgomaster (Mayence, 1671), in Leibnitz, *Deutschen Schriften, herausg. von Guhrauer*, th. i., § 264.

† On the arrangement of masses, see Encke, in Schum., *Astr. Nachr.*, 1843 Nr. 488, § 114.