ceased."* Thus we see in this simile, after the assumption of a *centrifugal* revolution which Empedocles perceived in the apparent rotation of the celestial sphere, a *centripetal force* gradually arise as an ideal antithesis. This force was specially and most distinctly described by the acute interpreter of Aristotle, Simplicius (p. 491, Bekker). He explains the *non-falling* of the celestial bodies thus: "that the centrifugal force predominates over the proper *fall-force, the drawing downward.*" These are the first conjectures respecting active central forces; and the Alexandrian, Johannes Philoponus, a disciple of Ammonius Hermea, probably of the sixth century, as it were, recognizing also the *inertia* of matter, first ascribes "the motion of the revolutionary planets to a *primitive impulse*," which he ingeniously (*De Creatione Mundi*, lib. i., cap. xii.) unites with the idea of the "fall, a tendency of all heavy and light bodies toward the Earth." We have thus endeavored to show how a great phenomenon of nature and the earliest purely *cosmical explanation* of a fall of aërolites essentially contributed in Grecian antiquity, step by step, but certainly not by mathematical reasoning, to develop the germ which, fostered by the intellectual labors of the following centuries, led to Huygens's discovery of the laws of circular motion.

Commencing from the *geometrical* relations of the periodic (not sporadic) falling stars, we direct our attention especially to what recent observations as to the *divergence* or *point of departure* of the meteors, and their *entirely planetary velocity*, have made known. Both these circumstances, divergence and velocity, characterize them with a high degree of probability as luminous bodies which present themselves independently of the Earth's rotation, and penetrate into our atmosphere *from without*, from space. The North American observations of the *November period* on the occasion of the falls of stars in 1833, 1834, and 1837, indicated as the *point of departure* the star γ Leonis; the observations of the August phenomenon, in the year 1839, Algol in Perseus, or a point between Perseus and Taurus. These centers of divergence were about the constellations toward which the Earth moved at the same epoch.† Saigey, who has submit-

* The remarkable passage alluded to in the text in Plutarch, *De Facie in Orbe Lunæ*, p. 923, is literally translated, "However, the motion of the Moon and the violence of the revolution itself prevents it from falling, just as things placed in a sling are prevented from falling by their motion in a circle."

† *Cosmos*, vol. i., p. 118, 119