

Per darana per cædes, ab ipso
 Suunit opes animumque ferro.

Untamed its pride, unchecked its course,
 From foes and wounds it gathers force.

We have spoken of the influence of the motion of the earth on the motions of bodies at its surface; but the notion of a physical connection among the parts of the universe was taken up by Kepler in another point of view, which would probably have been considered as highly fantastical, if the result had not been, that it led to by far the most magnificent and most certain train of truths which the whole expanse of human knowledge can show. I speak of the persuasion of the existence of numerical and geometrical laws connecting the distances, times, and forces of the bodies which revolve about the central sun. That steady and intense conviction of this governing principle, which made its development and verification the leading employment of Kepler's most active and busy life, cannot be considered otherwise than as an example of profound sagacity. That it was connected, though dimly and obscurely, with the notion of a central agency or influence of some sort, emanating from the sun, cannot be doubted. Kepler, in his first essay of this kind, the *Mysterium Cosmographicum*, says, "The motion of the earth, which Copernicus had proved by *mathematical* reasons, I wanted to prove by *physical*, or, if you prefer it, *metaphysical*." In the twentieth chapter of that work, he endeavors to make out some relation between the distances of the Planets from the Sun and their velocities. The inveterate yet vague notions of forces which preside in this attempt, may be judged of by such passages as the following:—"We must suppose one of two things; either that the moving spirits, in proportion as they are more removed from the sun, are more feeble; or that there is one moving spirit in the centre of all the orbits, namely, in the sun, which urges each body the more vehemently in proportion as it is nearer; but in more distant spaces languishes in consequence of the remoteness and attenuation of its virtue."

We must not forget, in reading such passages, that they were written under a belief that force was requisite to keep up, as well as to change the motion of each planet; and that a body, moving in a circle, would *stop* when the force of the central point ceased, instead of moving off in a tangent to the circle, as we now know it would do. The force which Kepler supposes is a tangential force, in the direction of the body's motion, and nearly perpendicular to the radius; the