

orbits at a distance 44 times greater than that of Uranus; nay, in those comets whose nucleus appears to us, from its inconsiderable mass, like a mere passing cosmical cloud, the Sun exercises its attractive force on the outermost parts of the emanations radiating from the tail over a space of many millions of miles. Central forces, therefore, at once constitute and maintain the system.

Our Sun may be considered as at rest when compared to all the large and small, dense and almost vaporous cosmical bodies that appertain to and revolve around it; but it actually rotates round the common center of gravity of the whole system, which occasionally falls within itself, that is to say, remains within the material circumference of the Sun, whatever changes may be assumed by the positions of the planets. A very different phenomenon is that presented by the translatory motion of the Sun, that is, the progressive motion of the center of gravity of the whole solar system in universal space. Its velocity is such\* that, according to Bessel, the relative motion of the Sun, and that of 61 Cygni, is not less in one day than 3,336,000 geographical miles. This change of the entire solar system would remain unknown to us, if the admirable exactness of our astronomical instruments of measurement, and the advancement recently made in the art of observing, did not cause our advance toward remote stars to be perceptible, like an approximation to the objects of a distant shore in apparent motion. The proper motion of the star 61 Cygni, for instance, is so considerable, that it has amounted to a whole degree in the course of 700 years.

The amount or quantity of these alterations in the fixed stars (that is to say, the changes in the relative position of self-luminous stars toward each other), can be determined with a greater degree of certainty than we are able to attach to the genetic explanation of the phenomenon. After taking into consideration what is due to the precession of the equinoxes, and the nutation of the earth's axis produced by the action of the Sun and Moon on the spheroidal figure of our globe, and what may be ascribed to the transmission of light, that is to say, to its aberration, and to the parallax formed by the diametrically opposite position of the Earth in its course round the Sun, we still find that there is a residual portion

\* Bessel, in Schum., *Jahrb. für 1839*, s. 51; probably four millions of miles daily, in a *relative* velocity of at the least 3,336,000 miles, or more than double the velocity of revolution of the Earth in her orbit round the Sun.