

viating but little from circles. It is only in the case of our moon, and perhaps in that of the first and innermost of the satellites of Saturn (0.068), that we discover an eccentricity greater than that of Jupiter; according to the very exact observations of Bessel, the eccentricity of the sixth of Saturn's satellites (0.029) exceeds that of the Earth. On the extremest limits of the planetary system, where, at a distance nineteen times greater than that of our Earth, the centripetal force of the Sun is greatly diminished, the satellites of Uranus (which have certainly been but imperfectly investigated) exhibit the most striking contrasts from the facts observed with regard to other secondary planets. Instead, as in all other satellites, of having their orbits but slightly inclined toward the ecliptic and (not excepting even Saturn's ring, which may be regarded as a fusion of agglomerated satellites) moving from west to east, the satellites of Uranus are almost perpendicular to the ecliptic, and move retrogressively from east to west, as Sir John Herschel has proved by observations continued during many years. If the primary and secondary planets have been formed by the condensation of rotating rings of solar and planetary atmospheric vapor, there must have existed singular causes of retardation or impediment in the vaporous rings revolving round Uranus, by which, under relations with which we are unacquainted, the revolution of the second and fourth of its satellites was made to assume a direction opposite to that of the rotation of the central planet.

It seems highly probable that the period of rotation of *all* secondary planets is equal to that of their revolution round the main planet, and therefore that they always present to the latter the same side. Inequalities, occasioned by slight variations in the revolution, give rise to fluctuations of from 6° to 8° , or to an apparent libration in longitude as well as in latitude. Thus, in the case of our moon, we sometimes observe more than the half of its surface, the eastern and northern edges being more visible at one time, and the western or southern at another. By means of this libration* we are enabled to see the annular mountain Malapert (which occasionally conceals the Moon's south pole), the arctic landscape round the crater of Gioja, and the large gray plane near Endymion, which exceeds in superficial extent the *Mare Vaporum*. Three sevenths of the Moon's surface are entirely

* Beer and Mädler, *op. cit.*, § 185, s. 208, and § 347, s. 332; and in their *Phys. Kenntniss der himml. Körper*, s. 4 und 69, Tab. 1 (Physical History of the Heavenly Bodies).