

falsehood, and the alternations of hope and sorrow, of vexation and triumph, through which he had gone. It will not be necessary for us to cite many passages of these kinds, curious and amusing as they are.

One of the most important truths contained in the motions of Mars is the discovery that the plane of the orbit of the planet should be considered with reference to the sun itself, instead of referring it to any of the other centres of motion which the eccentric hypothesis introduced: and that, when so considered, it had none of the librations which Ptolemy and Copernicus had attributed to it. The fourteenth chapter of the second part asserts, "*Plana eccentricorum esse ἀτάλαντα;*" that the planes are *unlibrating*; retaining always the same inclination to the ecliptic, and the same *line of nodes*. With this step Kepler appears to have been justly delighted. "Copernicus," he says, "not knowing the value of what he possessed (his system), undertook to represent Ptolemy, rather than nature, to which, however, he had approached more nearly than any other person. For being rejoiced that the quantity of the latitude of each planet was increased by the approach of the earth to the planet, according to his theory, he did not venture to reject the rest of Ptolemy's increase of latitude, but in order to express it, devised librations of the planes of the eccentric, depending not upon its own eccentric, but (most improbably) upon the orbit of the earth, which has nothing to do with it. I always fought against this impertinent tying together of two orbits, even before I saw the observations of Tycho; and I therefore rejoice much that in this, as in others of my preconceived opinions, the observations were found to be on my side." Kepler established his point by a fair and laborious calculation of the results of observations of Mars made by himself and Tycho Brahe; and had a right to exult when the result of these calculations confirmed his views of the symmetry and simplicity of nature.

We may judge of the difficulty of casting off the theory of eccentrics and epicycles, by recollecting that Copernicus did not do it at all, and that Kepler only did it after repeated struggles; the history of which occupies thirty-nine Chapters of his book. At the end of them he says, "This prolix disputation was necessary, in order to prepare the way to the natural form of the equations, of which I am now to treat.⁷ My first error was, that the path of a planet is a perfect circle;—an opinion which was a more mischievous thief of my time,

⁷ *De Stellâ Martis*, iii. 40.