

(as Nebulæ, the Magnitude of Stars, and the like), the orbits of several double stars are computed by the aid of the new observations. But Sir John Herschel's conviction on the point in question, the operation of the Newtonian law of gravitation in the region of the stars, is expressed perhaps more clearly in another work which he published in 1849.¹¹ He there speaks of Double Stars, and especially of *gamma Virginis*, the one which has been most assiduously watched, and has offered phenomena of the greatest interest.¹² He then finds that the two components of this star revolve round each other in a period of 182 years; and says that the elements of the calculated orbit represent the whole series of recorded observations, comprising an angular movement of nearly nine-tenths of a complete circuit, both in angle and distance, with a degree of exactness fully equal to that of observation itself. "No doubt can therefore," he adds, "remain as to the prevalence in this remote system of the Newtonian Law of Gravitation."

Yet M. Yvon de Villarceau has endeavored to show¹³ that this conclusion, however probable, is not yet proved. He holds, even for the Double Stars, which have been most observed, the observations are only equivalent to seven or eight really distinct data, and that seven data are not sufficient to determine that an ellipse is described according to the Newtonian law. Without going into the details of this reasoning, I may remark, that the more rapid relative angular motion of the components of a Double Star when they are more near each other, proves, as is allowed on all hands, that they revolve under the influence of a mutual attractive force, obeying the Keplerian Law of Areas. But that, whether this force follows the law of the inverse square or some other law, can hardly have been rigorously proved as yet, we may easily conceive, when we recollect the manner in which that law was proved for the Solar System. It was by means of an error of *eight minutes*, observed by Tycho, that Kepler was enabled, as he justly boasted, to reform the scheme of the Solar System,—to show, that is, that the planetary orbits are ellipses with the sun in the focus. Now, the observations of Double Stars cannot pretend to such accuracy as this; and therefore the Keplerian theorem cannot, as yet, have been fully demonstrated from those observations. But when we know

¹¹ *Outlines of Astronomy.*

¹² *Out.* 844.

¹³ *Connaissance des Temps*, for 1852; published in 1849.