

With this brief and imperfect account we must now regretfully leave the subject, consoling ourselves with the reflection that Dr. Fricke's book contains in itself that which will most certainly attract deserved attention to this most beautiful of Klein's creations.

F. N. COLE.

ANN ARBOR, December 30, 1891.

PERTURBATIONS OF THE FOUR INNER PLANETS.

Periodic Perturbations of the Longitudes and Radii Vectors of the Four Inner Planets of the First Order as to the Masses. Computed under the direction of SIMON NEWCOMB. Washington, Navy Department, 1891; 4to, pp. 180.

THIS work forms the concluding part of volume III. of a series of astronomical researches, published under the general title, "*Astronomical Papers, prepared for the use of the American Ephemeris and Nautical Almanac.*"

During the past twelve years, one of the principal works which has been in progress at the office of the Nautical Almanac is that of collecting and discussing data for new tables of the planets. The most recent existing tables, which are now used in all European Ephemerides, are those of Leverrier, the construction of which was the greatest work ever undertaken by that celebrated astronomer. The first tables published, those of the Sun, were issued in 1858; those of Uranus and Neptune appeared about 18 years later. The whole work probably took about 25 years in preparation and publication. Yet the number of observations on which the tables were actually based was only a few hundred in the case of each planet, about 500 being used for Venus, 800 for Mars, and probably yet fewer in the cases of the other planets. The results were not completely discussed, and, in consequence, different data were employed in different tables, making it extremely difficult for future astronomers to derive the results of comparing them with future observations. None except those of the Sun and Mercury, which were the first issued, have shown a satisfactory agreement with subsequent observations. The error in the geocentric place of Venus at the time of the recent transit was surprisingly great, amounting to no less than nine seconds in longitude.

The actual number of observations now available for each of the principal planets is several thousand. The recent ones