center of figure and the center of gravity of the moon. I have shown that Hansen fails to sustain this position, and that there is no good reason to suppose that the moon differs from any other of the heavenly bodies in this respect.* Our first course would therefore be to diminish all of Hansen's inequalities by this factor, were it not that there are reasons why each of the two greatest perturbations of the moon's motion,—the evection and the variation,—should be found larger from observation than he found them from theory.

Evection.—The evection has the eccentricity as a factor; the value of the other factor being nearly 0.4. If, then, the adopted eccentricity of the moon be erroneous, the computed evection will be erroneous by four-tenths the amount of the error. Now, by reference to Hansen's "*Darlegung der theoretischen Berechnung der in den Mondtafeln angewandten Störungen*"† (page 173), it will be seen that the eccentricity adopted throughout in the computation of the perturbations of the moon is less by 0.0000073 than the value he finally found from observation, and adopted in the tables. Had he used the latter value, the theoretical evection would have been greater by the fraction $\frac{.0000073}{.0549008} = 0.000133$. The factor actually used being 0.0001544, the evection, thus increased, is too large by only 0.000021 of its entire amount, or $0''.09$. Consequently, the tabular coefficient of evection should be diminished by this amount. Precisely the same result follows, if we adopt Hansen's view of a separation of the centers of figure and gravity of the moon; and Hansen himself is led to it on page 175 of the work cited, only instead of $0''.09$, he says, "kein volles Zehntheil einer Secunde."

Variation.—That the coefficient of variation resulting from meridian observations will be greater than the actual coefficient may be anticipated from the following considerations. The inequality in question attains its maxima and minima in the moon's octants. In the first octant, we have a maximum. The elongation of the moon from the sun is then about 3^h; and the observed position of the moon is mainly dependent on observations of the first limb made in the daytime, when the apparent semi-diameter of the moon will be diminished by the brilliancy of the surrounding sky. No account of this diminution of the apparent semi-diameter being taken in the reductions, the semi-diameter actually applied is too large, and the observed right ascension of the moon is also too large.

When the moon reaches the third octant, the value of the variation attains its minimum. The moon then transits at 9^h, and the meridian observation is made on the first limb, while the apparent semi-diameter is increased by the irradiation consequent upon the contrast between the moon and the sky. The result will be that the observed right ascension will be too small.

The same causes will make the observed right ascension too great in the fifth octant, and too small in the seventh. These positive and negative errors of observed right ascension correspond to the times of maximum and minimum effects of variation in increasing the longitude of the moon. Therefore, the observed variation will appa-

* Proceedings of the American Association for the Advancement of Science, 1868.—Silliman's American Journal of Science, November, 1868.

† Abhandlungen der mathematisch-physischen Classe der Königlich-Sächsischen Gesellschaft der Wissenschaften Band vi.