mum and two minima. The first minimum occurred on July 8, the minimum brightness being 1 step $>$ DM. 43°,4002, and 4 steps $<$ DM. 44°,3889, or $6^{M}.7$. The second minimum, of the same brightness, was passed on November 5, the interval between the two minima being 120 days. The maximum occurred on September 10, when the brightness was 2 steps $>$ DM. 44°,3889, and 4 steps $<$ DM. 46°,3305, or $6^{M}.3$. A maximum also occurred about May 14 (increase of light not well observed), and the star was again apparently at maximum when the observations terminated.

8. *ρ Persei.*

The observations on this star were continued (from the series published in No. 151 of this Journal, and extending from January 1) until April 22, and also from October 2 to December 24, 18 observations. The light remained nearly constant until November 4, when it decreased 4 or 5 steps, and so remained until December 21. The minimum occurred about November 24.

9. *R Virginis.*

This star was observed on 12 evenings, from March 6 to April 29. When first seen, *R* was 5+ steps $<$ DM. 8°,2626, or about $9^{M}.0$. The increase of light was rapid and uniform, a maximum being passed on April 8. Maximum brightness 3 steps $>$ DM. 8°,2634, and 4 steps $<$ combined light of DM. 8°,2620, 21, or about $8^{M}.0$; this representing a faint maximum. When last observed, *R* was = DM. 8°,2634, and 3 steps $>$ DM. 8°,2626, or $8^{M}.2$.

10. *g Herculis.*

The obervations on this star extended from March 28 to November 27, and are 25 in number. The charted observations exhibit but one maximum and one minimum. The minimum occurred on June 14, and was a faint one. The maximum was passed about September 20. The light remained nearly constant from July 19 to November 4, a period of 108 days.

11. *R Ursae Majoris.*

8 scattering observations were obtained on this star, extending from March 24 to June 4. When first seen, *R* was 5+ steps $<$ DM. 70,622, or about $8^{M}.8$. The increase of light appeared quite rapid, and a maximum was passed about April 29. When last observed, on June 4, *R* was = DM. 69°,584, and 3 steps $<$ DM. 69°,579. or $8^{M}.2$.

Cambridgeport, 1887 *September* 13.

ON THE STRUCTURE OF *13 M HERCULIS*,

By Prof. MARK W. HARRINGTON.

The great cluster in *Hercules* has been frequently figured and always, with one exception, as a globular mass of stars much condensed in the center. Lord Rosse's observers alone found it crossed by three dark rifts, as shown in Figure 1, which is a copy of their drawing, the position only being changed in order to bring the notable hook above.

Fig. 1. The Great Cluster as seen in Lord Rosse's Reflecting Telescope — the Hook above.

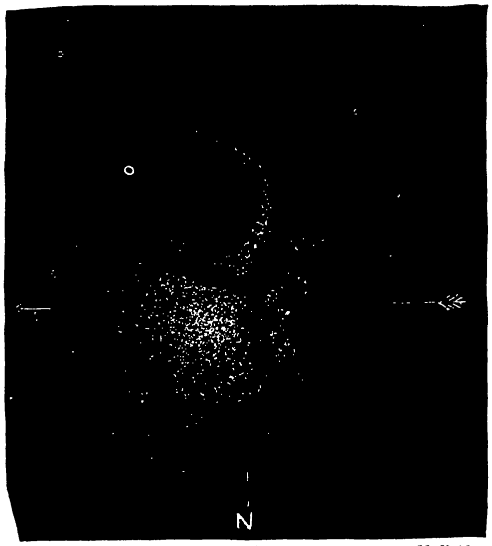
Last spring I spent some time in studying this cluster with the aid of Mr. H. C. Markham, an artist whose sight I have found to be remarkably keen. We very soon found that under favorable circumstances, and with high powers, we were able to see the rifts which had been figured by Lord Rosse, and this was done before Mr. Markham knew of Lord Rosse's drawing. The rifts were somewhat difficult objects, but with proper precautions, they were frequently seen by Mr. Markham and myself, and also by Assistant Schaeberle. After following them for about a month the drawing, Figure 2, was made. I could not, however, make any measurements, as after illumination of the wires of my micrometer, I could not see the rifts.

The rifts were seen with both the 6-inch and 12-inch equatorials. They came out more and more plainly with increase of magnifying power, until 500 or 600 was reached. With higher powers the rifts seemed to increase and spread, and the cluster broke up into small clusters and scattered stars.

The resemblance of Figure 2 to Figure 1 is unmistakable. Taking the hook above as a starting point we have the three canals radiating in the one case as in the other.

The absence of the brighter outlying stars in Figure 2 is without significance, as no attempt was made to include

FIG. 2. THE GREAT CLUSTER WITH A POWER OF 500 OR 600, ANN ARBOR.



H. MARKHAM. April 13, 1887. 11 P.M.

them. Aside from that, while the general resemblance between the two figures is notable, the differences in detail are remarkable. The upper or south rift is much broader and shorter in the later figure. The preceding rift is the best marked, and is much alike in the two drawings. The north or lower rift is much less marked, and is decidedly shorter in the later figure. In Lord ROSSE's drawing the radiating point of the rifts is nearly central; in Mr. MARKHAM's it is shifted backwards. In the first the central condensation is not marked; in the second it is preceding and slightly below the radiating point. I may say that the drawing was made before we permitted ourselves to refer to Lord ROSSE's drawing. As to the significance of these rifts I can not make any suggestion. They are so elusive that I sometimes almost doubted their existence, but I found that with patience I could always see them; and when after the completion of our drawing we finally compared it with Lord ROSSE's, we could no longer doubt that we had seen what had been seen by his observers. Whatever the rifts are, it seems certain that they have shifted their position slightly in the fifty or more years which have elapsed since the first drawing was made.

Observatory, *Ann Arbor*, 1887 *August* 29.

NOTE ON THE DETERMINATION OF THE CONSTANT OF ABERRATION,

BY PROF. GEORGE C. COMSTOCK.

In the *Comptes Rendus* for January 11, 1886, M. LOEWY has suggested the mounting of a prism with silvered faces in front of the objective of an equatorial telescope in such a manner that rays of light coming from two stars in very different parts of the heavens may be simultaneously reflected into the telescope, and he has shown that the angular distance between two stars may be very accurately measured in this way. The distance will be, in fact, twice the angle of the prism plus the apparent distance of the stars as seen in the field of the telescope. In subsequent numbers of the *Comptes Rendus* an analysis is made of the application of this method to the determination of the constant of aberration. A *résumé* of these papers is contained in the *Bulletin Astronomique* for April and June, 1887, and need not be reproduced here, as the purpose of the present article is to consider a single feature of the method, the proper value to be assigned to the angle of the prism.

If we denote by A the angle between the reflecting surfaces of the prism, by d the measured distance between the reflected images of two stars as seen in the field of view of the telescope, and by Δ the angular distance of the two stars, and neglect for the present the effect of refraction upon this distance, we shall have

$$\Delta = 2A + d$$

The effect of aberration upon the apparent distance of two stars is,

$$-2k \cos\beta \sin \tfrac{1}{2}\Delta \ \sin(\odot - \lambda)\,,$$

k denoting the constant of aberration, $\odot$ the sun's longitude, and λ and β the longitude and latitude of the middle point of the arc joining the two stars. If the apparent distance of the stars is measured at the instants when $\odot = \lambda + 90°$ and $\lambda - 90°$, we shall have at these two epochs respectively,

$$\Delta_1 = 2A + d_1 = \Delta_0 - 2k \cos\beta \sin \tfrac{1}{2}\Delta_0$$
$$\Delta_2 = 2A + d_2 = \Delta_0 + 2k \cos\beta \sin \tfrac{1}{2}\Delta_0$$

If it could be assumed that the angle of the prism, A, was