lactic ellipse. It is hoped that by this process the parallax of from ten to fifteen stars at the least will be determined within the year.

Forming my expectations from the experience of the past, I am led to hope that the parallaxes of all stars will in general be determinable by this method when they are not less than the thirtieth of a second of arc; for I find from the calculations of actual instances, that the probable error of a single night's measure of a "distance" does not sensibly exceed the tenth of a second; and inasmuch as the square root of the weight of π derived from the solution of a typical normal equation is 3·6, the probable error of π will not exceed the thirtieth of a second.

In the first instance I propose to apply this method systematically to all those stars between the magnitudes of $1\frac{1}{2}$ and $2\frac{1}{2}$, which attain at Oxford a sufficient altitude, and in fact it is already in course of application to α, β, γ *Cassiopeiæ*, and to γ and ϵ *Cygni*.

Certain cosmical relations cannot be safely inferred excepting from the parallaxes of numerous stars, and for such purposes *classes* of sufficiently approximate parallaxes will be more valuable than somewhat more accurate determinations in isolated cases.

I had hoped to have completed by this time the final determination of *Polaris* by the more elaborate process applied to 61 *Cygni*. The serious interruptions which have been already alluded to necessitate the continuance of the measures until June next. Meanwhile, I may mention that the curtailed process of selected nights has given a parallax amounting to 0″·052; a value which, according to Mr. Maxwell Hall, is close to the mean 0″·043 of all the determinations made by preceding astronomers.

Photographs of the Nebulæ 57 *M. Lyræ; 27 M. Vulpeculæ; the Cluster* 13 *M. Herculis; and of Stars in Cygnus.* By Isaac Roberts.

57 *M. Lyræ.*

Seven photographs of this annular nebula were obtained between July 14 and 31, 1887, with exposures varying between 10 and 60 minutes' duration. The enlargements (one 3 times and the other 25 times) which I now submit are from the negative taken on July 31, with an exposure of 20 minutes. Each of the negatives exposed for 15 minutes and upwards shows with much density the ring. The central star is also visible on each, though it is faintly seen on some; the light is therefore, photographically, very active. The interior of the ring is filled with faint nebulous matter, thus confirming the character given of it by Sir J. Herschel; but there is no evidence

of resolvability as suggested by the Earl of Rosse, and asserted by Secchi.

The photographs show the ring about the extremities of the major axis fainter than the remainder, and that there are protrusions somewhat beyond a line that would form the ellipse quite symmetrical.

Sir J. Herschel * states that the 11th mag. star following is distant about the breadth of the ring from the nebula, but the photographs show it to be less than half that distance removed.

The Earl of Rosse † shows filaments round the outer edge of the nebula which the photographs do not, but all the negatives clearly show the central star, which is not indicated by Sir J. Herschel or the Earl of Rosse. They refer to the internal nebulosity which by the photographs is much fainter than the star, yet neither of them has seen it, and, therefore, the suggestion that the star is variable receives here some confirmation.

27 *M. Vulpeculæ.*

Seven photographs of this nebula also were obtained between July 31 and October 10 this year, with exposures varying between 15 minutes and 2 hours' duration; but the atmospheric and other circumstances during the opposition this year were unfavourable to long exposures, and the light of the nebula is very feeble. Therefore this photograph taken on August 27 last, with exposure of 90 minutes (enlarged 15 times), does not exhibit the details that could be shown under good conditions; but it is clearly an elliptical nebula, and the drawing of it by Mr. Lassell in the *Memoirs* of the Society for 1866 (omitting the stars and internal details) agrees well with the photographs, and so also does the drawing by the Earl of Rosse in 1861.

Cluster 13 *M. Herculis.*

The two photographs (enlarged 3 times and 15 times) are from a negative taken, with an exposure of 60 minutes, on May 22 of this year. Sir J. Herschel and the Earl of Rosse have given drawings of this cluster, but as the positions of the stars in them are only roughly indicated, they cannot usefully be compared with the photographs. Sir J. Herschel says * there must be thousands of stars in it; it does not come up to a nucleus, has hairy-looking curvilinear branches, indicates a globular form not much denser at the centre.

The Earl of Rosse says ‡ it seems to have a dark streak across the bright part, a little above the centre; dark spaces seen through mist.

Several of these descriptions are confirmed by the photographs, but two prominent features are omitted by both observers, namely, the nebulosity of the individual stars and the cluster itself being involved in nebulosity.

* *Phil. Trans.* 1833. † *Ibid.* 1844. ‡ *Ibid.* 1861.

These features are best seen on the negatives, though they are also well shown on the enlargements.

Stars in Cygnus.

Admiral Mouchez presented to the Society four beautiful photographs, by the Brothers Henry, of stars in *Cygnus*. One of them taken on August 14, 1885, has A. R. $19^h\ 45^m$ and D. $35°\ 30'$. On August 23, 1886, I took a photograph of the same sky space, and on August 14 this year again another. These have been enlarged 3 times, and they serve to illustrate what has frequently happened in my experience of stellar photography—that with similar plates, exposed to a given sky space for an equal length of time, and apparently with equal clearness of sky, there are surprising differences in the number of the stars that can at any time be photographed.

In the three photographs to which reference is here made these differences are remarkable, and to enable us to appreciate them, I counted one-eighteenth (17·75) of the stars upon corresponding areas on each plate respectively, and by measurements and calculations founded upon these data arrived at the following results :—

1st. The number of stars upon MM. Henry's plate in 1885 equal	3124
2nd. The number of stars upon my plate of 1886, having a sky area coincident with that of MM. Henry's plate equal	5023
3rd. The number of stars upon my plate of 1887 with coincident sky area equal	16206

The exposures in each case were of 60 minutes' duration, yet the third plate has upon it more than five times as many stars as the first.

These facts point out one of the difficulties that will be frequently met with by those who will be participating in the formation of the projected international photographic chart of the stars which is intended to include stars down to the 14th magnitude, with exposures of 15 minutes; but I am not here suggesting that the difficulties cannot be overcome. These discrepancies may be due to several causes, mechanical, chemical, and atmospheric, acting differently at different times.

On the Measurement of Celestial Photographs. (*Extract from a Letter to the President.*) By Isaac Roberts.

I wish to ascertain if some of the Fellows of the Society would be willing to engage in the scientific work of stellar photography by determining from negatives—

First. Stellar parallax.

Second. Stellar proper motion.

Third. Stellar photographic magnitudes.
Fourth. Stellar colour and variability.
Fifth. Stellar work not particularised above.

May I therefore ask you to communicate to the Fellows the offer that I should be willing to place in their hands such negatives as would enable a limited number of them to conduct with the necessary accuracy the investigations enumerated in these suggestions?

The essential equipment required by any worker would be: 1st, a good position micrometer; 2nd, a microscope of simple construction with 1-inch and 3-inch objectives, a sliding stage 7 inches × 7 inches (a plate of glass would do), and a reflecting mirror beneath it.

With such inexpensive appliances as here named astronomical work of the highest accuracy could be done, without the costly equatorial and transit instruments, and without the physical exposure at night which is unavoidable in using them.

I would supply the negatives free of cost, and only stipulate in return that each worker should have the necessary knowledge and perseverance to pursue the investigations he undertakes, and that he should communicate the results to the Society in a form acceptable to the Council.

1887, *November* 7.

On the Appearances presented by the Satellites of Jupiter during Transit, with a Photometric Estimation of their Relative Albedos, and of the Amount of Light Reflected from the Different Portions of an Unpolished Sphere. By Edmund J. Spitta.

Since their discovery by Galileo in 1610, the satellites of *Jupiter* have met with much attention, both from the mathematical as well as the physical astronomer. It is not the purpose, however, of this paper to deal with the former class of investigation, and only with so much of the latter as strictly relates to the appearances presented by the satellites during transit.

It is needless to state that during superior conjunction the satellites have from times most remote presented appearances not satisfactorily accounted for; appearances, too, which do not seem to apply equally to all the satellites, or even in some instances to the same satellite in two successive revolutions.

Passing over the first observation of the kind by Cassini in 1665, the next is recorded by Maraldi in 1707, who wrote two memoirs to the Paris Academy upon the subject, his interest having been excited by witnessing the third satellite transit as a dark spot on April 4, but as a white one during the next revolution on April 11. From this time up to the present date numerous observers, amongst whom might be mentioned