guiding and so result in unequal illumination of the slit. It is almost certain, however, from later experience that these plates give unreliable results.

A new prism spectrograph was erected in 1921. This was built specially for the Venus work, and, using it in conjunction with a large reflector arranged as a skew Cassegrain, a narrower slit could be used with a much larger image of Venus, and the exposure time could be reduced to between 30 and 40 minutes only. A series of twelve spectra photographed in November and December 1921 gave shifts in close agreement with the control plates of direct sun-light. The angle V–S–E was large, varying from 137° to 149°—that is to say, the light came from a hemisphere of the Sun facing away from the Earth about 142°, and this gave lines displaced towards the red by practically the same amount as is found in ordinary sun-light.

Further confirmation was obtained in a final series of six plates obtained in 1922 April and June, with the planet an evening star. These results I therefore take to be final in proving that the shift to the red is found in light coming from any part of the Sun.

Reviewing the evidence as a whole, there seems to me to be very little doubt that the Einstein effect is present in the solar spectrum. The observed shifts over the entire face of the Sun, and in the unseen hemisphere, seem impossible to explain by motion, pressure, or anomalous dispersion. Assuming the gravitational effect to be the principal factor, there now remains to be explained the considerable excess of shift shown by the high-level lines in the ultra-violet, especially at the Sun's limb, and the large differences of shift in individual lines observed throughout the spectrum. J. Evershed.

1923, Aug. 19.

CORRESPONDENCE.

To the Editors of 'The Observatory.'

Spectroscopic and Trigonometrical Parallaxes.

Gentlemen,—

In *Harvard Bulletin*, No. 789 (referred to in your August number), the spectroscopic parallax of ε Indi is given as 0″·45 and the suggestion is put forward that perhaps the trigonometrically-determined parallax 0″·28 may be too small. This suggestion is based on the idea that the spectroscopic and trigonometrical parallaxes, if without error, should be identical. This, however, is not the case. In *B. A. N.*, No. 19, I have shown that the state of ionization in a stellar atmosphere, which determines the relative line intensities, is not physically connected with the luminosity of the star, but with the value of gravity at the surface of the star—a simple fact which has also been remarked by others, though I have nowhere found it expressly stated. Thus, for the same spectral class, the spectrum will be related to the ratio of the luminosity to the mass; and this is the quantity that can be determined from the line intensities. In consequence, the spectroscopic and the real trigonometric parallaxes will differ when the individual mass M differs from the mean mass Mo of the group used in constructing the reduction curves:

$$M/Mo = (\text{spectr. par./trig. par.})^2.$$

For ϵ Indi, if both parallaxes are without error, the mass would come out 2·6 times the mean mass of this class (K5), which is not excessive.

The data required for the construction of the reduction curves connecting line intensities with the quantity L/M itself (stars with known mass and parallax) are very restricted. This difficulty may partly be removed by using all double stars with orbital motion and computing their luminosity by means of their hypothetical parallaxes (as has been done by Jackson and Furner). For, calling h the hypothetical parallax (derived on the assumption of a mass double that of the Sun), t the trigonometrical parallax, and l the apparent brightness, we have

$$L/M = (l/t^2)M^{-1} = (l/h^2)(4M)^{-\frac{1}{3}}.$$

Thus the correlation of l/h^2 with the line intensities in the spectrum will be much closer than the correlation of l/t^2 with them. The small variation of the mean factor $M^{-\frac{1}{3}}$ with spectral class may be taken into account by inserting Seares's values for the mean mass of each spectral class.

I am, Gentlemen,
Yours faithfully,
ANT. PANNEKOEK.

Amsterdam Astronomical Institute,
1923, Aug. 28.

The Origin of the Spiral Nebulæ.

GENTLEMEN,—

In the article by Prof. Perrine on "The Origin of the Spiral Nebulæ" mention is made by him of certain "established facts," which he makes the basis of discussion. The first is with regard to distribution, on which he says "They (the spirals) are condensed towards the polar regions of the Galaxy, the region of the Galaxy being essentially devoid of them." The results of an investigation by Hinks, and more recently by myself, do not bear this out at all. Full details will be found in *M. N.*, vol. lxxxiii, no. 3, but I may as well summarize the results here. Both in the North and South Galactic Hemispheres longitude is quite as important as latitude. It is found in the N. G. H. that over 85 per cent. of the spirals of 5′ diameter and over lie in the semihemisphere 50° to 230°, if the group in Virgo about 10° beyond this great circle is included. On the other hand, all the globular clusters in the N. G. H. are in the other semihemisphere, 230° to 50° (through 360°). There is a wide band of spirals stretching from the Ursa