With increasing improvement in the accuracy of the statistical data it may eventually become possible to separate the portion of α due to intrinsic light properties of the stars from that caused by the influence of scattering. At present such an attempt is scarcely warranted.

What is claimed here to have been proved is the fact that α, if not entirely, is at least mainly due to *optical* agencies. The assumption of a *uniform* luminosity-law cannot therefore be reconciled with the observational evidence, and hence the distribution of star matter derived from this assumption is open to grave doubt. Unless the observed facts are far less reliable than we have reason to believe, our conceptions of the structure of the universe have to be radically changed. Wherever observational evidence has placed us in a position to distinguish between the extreme conceptions, viz. homogeneous distribution of luminosities and heterogeneous distribution of star matter on the one hand, and heterogeneous distribution of luminosities combined with a homogeneous distribution of star matter on the other, the verdict has always been in favour of the latter assumption. It seems thus hardly possible to evade the conclusion that the apparent heterogeneity of the universe is largely an optical phenomenon. Stars in the galaxy appear to our eye more frequent than in high latitudes, not because they are more densely crowded but because they possess greater luminosities. Judging by the evidence here discussed, the commonly held conception of the stars round the sun forming an island universe separated from other similar systems by vistas of space devoid of star matter is at least open to serious doubt, and certainly will have to be rejected if more numerous and refined observations confirm the statistical data on which the present investigation is based.

On the Distribution of the Stars down to the 11th Magnitude. (*A reply to Dr. Nort.*) By Dr. A. Pannekoek.

(*Communicated by the Secretaries.*)

In our communication on the distribution of the stars to the 11th magnitude (*Monthly Notices*, **79**, No. 5) we have drawn attention to the fact that the method used by Mr. Henie and Dr. Nort for the derivation of the reduction to centre must give too large values for the plates which have their centres in the Milky Way. Dr. Nort has since re-examined this reduction for the galactic plates, by correcting all densities for difference of galactic latitude. Indeed he now finds for these plates a reduction to centre clearly smaller than in his first research, though still greater than for the plates at higher latitude, that gave the same reduction to centre as formerly.

According to his communication in the *Monthly Notices*, **79**, No. 9, Dr. Nort believes his first erroneous reduction to centre has also been the cause of the systematic differences I found between adjacent Harvard plates. If he was right, these differences should only occur, or at least should be greatest, at the limits of the dense galactic and the poor extra-galactic plates. A glance at the coefficients I deduced (*cf*. p. 334) shows this is not true; thus we find great differences between the plates 15 and 16 (ratio of densities 2·0), between 15 and 27 (ratio 2·7), 29 and 30 (ratio 2·0), 18 and 30 (ratio 2·7), 14 and 26 (ratio 2·4) that cannot be attributed to erroneous reductions to centre, as they are all plates with small or moderate density lying outside the Milky Way. Moreover, the new reduction to centre does not much deviate from the old: as for border stars lying 90–130 mm. from the centre, this deviation is only 0·10 to 0·16 magn. (old reductions $0^{m}\cdot62$ to $0^{m}\cdot95$, new reductions $0^{m}\cdot52$ to $0^{m}\cdot79$). The error caused by it in the reduction of density to centre, taken as a logarithm, is not more than 0·07, corresponding to a ratio of 1·18. By this quantity our results for the dense galactic plates should be corrected, and such differences could be explained in the way suggested by Dr. Nort. But as it is much smaller than the plate coefficients I found, these cannot be explained in this way, and they will not be materially changed by the new results of Dr. Nort.

Dr. Nort finds another ground of criticism in the fact that in my reduction of adjacent plates to each other I could only make use of the border portions, that are the worst parts of the plates. Generally speaking, he is certainly right; but the question is, how great the errors thus introduced may be? In this we need not restrict ourselves to general statements, as by the extent of their mutual agreement the different results themselves show the degree of their uncertainty. Now, we have stated already: "As the mean error of a result of log C is 0·05, and as 35 out of 55 values are 0·10 or more, and 10 values are 0·20 or more, the reality of the majority of these corrections stands beyond doubt" (p. 334). This means, that though I was obliged to use the worst parts, the differences between the limiting magnitude and mean densities of different plates are so great, that their neglect leaves much greater errors than are introduced by the comparison of border parts.

To test this I have still used another method. In my research I have computed the mean density for each of the four quadrants of each plate and its logarithmic deviation from a normal spheroidal star system (*cf*. Table II., last column). The mutual differences of these four values belonging to the same plate do not depend on the plate coefficients used, and the mean error of a logarithmic deviation computed from them gives a measure for the real irregularities at the sky. When we take, however, four quadrants lying on four plates around their common edge, in their mutual differences the systematic plate-errors play a rôle. Using in this way all the edges on declination $+15°$ and $-15°$, and all the plates at declination $+30°$, $0°$, $-30°$, I found for the mean error

from quadrants on the same plate $\sqrt{0.0077} = 0.09$
from adjacent plates, numbers of Nort, uncorrected $\sqrt{0.0149} = 0.12$
from adjacent plates, corrected $\sqrt{0.0086} = 0.09$

This proves in still another way that the coefficients I applied really ameliorate the data of Dr. Nort, and that by applying them the greater part of the irregularities due to the plates are removed.

Dr. Nort seems to believe that his criticism also throws doubt on my results as to the centres of paucity or funnel-shaped holes in Taurus and Ophiuchus; so I must emphasise that they are confirmed by most catalogues and charts that are able to show the general distribution of the stars, such as the Bonner Durchmusterung and the catalogue plates of the Carte du Ciel as well as the chart plates so far as they have been published.

Monochromatic Photographs and Photometric Measures of the Dumb-Bell Nebula (N.G.C. 6853). By J. H. Reynolds.

This nebula, although it is not usually included amongst the planetaries, has undoubtedly the principal characteristics of the class. These characteristics may be summarised as—

1. A gaseous emission spectrum.
2. A definite circular, elliptical, or compound elliptical outline.
3. The presence of a central star.

All these are represented in the nebula, and it should be therefore regarded as a true planetary, notwithstanding its large size.

The spectrum is unusually simple for a nebula of this class, as it appears to be entirely concentrated visually in the nebulium radiation at λ 5007 and photographically in the radiation λ 3727, the hydrogen radiations being either altogether absent or so faint as to be imperceptible visually or photographically. The nebulium radiations also at λ 4958 and λ 4363 are probably not represented.

Visual observations of the spectrum were made on several occasions with the 28-inch reflector and a Hilger direct-vision slit spectroscope of considerable dispersion. Only the strong line at λ 5007 was seen, no other lines being even suspected. An exposure of two hours with a two-prism spectrograph on a panchromatic plate yielded no lines at all. In this case the radiation at λ 3727 was not included on the plate, and the insensitiveness of the plate to the blue green was no doubt responsible for the absence of λ 5007. Von Gothard, however, records an exposure of 90 minutes with an objective prism which yielded a strong monochromatic image at λ 3727 alone, as if no prism had been interposed in front of the lens.*

* *Ast. Nach.*, No. 3738, "Die Enstehung der photographischen Aureole um die Nova (3, 1901) Persei."