the m. e. of an average of 40 values becomes ± 0.018. The regular course exhibited by the results therefore must be real. The 4th column shows the real range, corresponding to each half unit; from them we find the corrections to be applied to each estimated value of d (strictly speaking for 0.45, 0.95, 1.45 etc., but they may be taken for 0.5, 1, 1.5 etc.). As one scale unit on the average corresponds to 0.3 to 0.5 magnitude, this means corrections to the magnitudes in the D. M. of S. A. varying between $+0.^m07$ and $-0.^m06$.

As corrections to the individual magnitudes these corrections may on the whole be safely neglected. It is otherwise, however, with the counted numbers used in statistical researches on the structure of the stellar system; for these numbers may be $^1/_5$ too large or too small. For correcting them we may use the following curve.

d	Corr. to log. A	d	Corr. to log. A
0.5	+ 0.01	5.5	+ 0.02
1.0	− 05	6.0	00
1.5	− 08	6.5	+ 02
2.0	− 06	7,0	+ 04
2.5	− 03	7.5	+ 03
3.0	00	8.0	+ 01
3.5	+ 03	8.5	− 01
4.0	+ 06	9.0	− 03
4.5	+ 07	9.5	− 05
5.0	+ 05	10.0	− 05

The differences between the values of the table and this curve give a mean error of ± 0.018, just equal to the value computed a priori.

The distance of the Galaxy in Cygnus, by *A. Pannekoek*.

The problem of the distance of the star masses causing the galactic light has raised many controversies. EASTON found a correlation between the density of 9th magnitude stars and the brightness of the galactic light; and from the distribution of the B. D. stars he derived (*Aph. J.*, **12**, 1900; *Memoirs Amst. Ac.* 1903) that from a central nucleus, appearing to us as the great luminous Cygnus-cloud (between β and γ Cygni) spiral arms emanate, that form the branches and the main stream of the Milky Way. On the other hand the author found (*Proc. Amst. Ac.* 1910) that the stars constituting the great Cygnus-cloud only become manifest in a strong increase of the number of stars below the 12th mag., thus having no real connection with the stars of the 9th mag.; from these data afterwards (*M. N.* **79**, 500) a distance of 40 000 parsecs was derived for this starcloud.

EASTON has tried to arrive at a decision in this dilemma by using data on spectra and proper motions (*M. N.* **81**, 215). If part of the stars composing a starcloud show as bright as 9^m, we must find among the 9^m stars in the direction of this starcloud a greater percentage of distant first-type stars with imperceptible proper motions than among such stars in adjacent dark regions. EASTON compares in five regions of the Galaxy the percentage of first type stars and the mean centennial p. m. for adjacent dark and bright parts; if we extract from his tables the difference (Bright—Dark) in percent first type stars, and the difference (Dark—Bright) in the mean p. m. (the + sign denoting positive evidence in both cases) we find:

Region	Spectra	Proper Motions				All
		>7.0	7–8	8–9	<9	
1	+ 6%	+0.″7	−0.″4	0.0	−0.″5	−0.″3
2	− 28%	+0.7	+0.3	−0.5		+0.3
3	+ 6%	+0.4	+0.9	−0.2		+0.5′
4	+ 35%	+0.2	−1.6	+0.7		0.0
5	+ 14%	+1.1	−0.4	+1.4	+0.8	+1.0
Mean 1–5		+0.6	−0.2	+0.3	+0.2	+0.3
Mean 1–4		+0.5	−0.2	0.0		+0.1

The condition, that the bright and the dark parts of each region must have the same latitude, is fulfilled in 1–4, but not in 5 (Taurus). Here the bright part lies on the galactic circle, the dark part at some distance south, and moreover in the region of the dark absorbing nebulae, which by blotting out the distant stars must cause an increase of the mean proper motion. So region 5 should be excluded; and the remaining positive evidence is so small, that these results cannot bring any decision.

If the number of 9^m stars pro square degree is greater in bright regions than in dark ones, this may generally be taken in favour of EASTON's opinion. But this criterion must be used with caution, because absorbing nebulous masses diminish in just the same way the galactic light of perhaps very distant starclouds and the number of D. M. stars situated at much smaller distance.

I have tried to elucidate the particularities of the Cygnus-region by computing the space-density from different data of star numbers by means of the formulae given in my paper „The local starsystem" (*Proc. Amst. Ac.* 1921). At first the number of stars (pro half-magnitude) counted in *Selected Area* 64 (situated at the border of the great Cygnus cloud) has been treated; after having been corrected for systematic error they yield the following values of log A_m (number of stars between $m - \frac{1}{2}$ and $m + \frac{1}{2}$ pro square degree)

$m =$	11	11.5	12	12.5	13	13.5	14	14.5	15
counted	16	25	53	90	82	145	226	365	
log A_m	1.80	2.01	2.40	2.62	2.63	2.83	2.95	3.16	

The coefficient c of a quadratic formula cannot be derived with sufficient accuracy; for this reason these values have been represented by a linear formula $2.65 + 0.338\ (m - 13.25)$, or reduced to visual scale $2.65 + 0.356\ (m - 12.61)$. The resulting density is given by $\log \Delta = 9.72 - 0.244\ (\rho - 15.07)$. This means, that a mass of stars having density 1 at $\rho = 14$ (630 parsecs) and decreasing to 0.3 at $\rho = 16$ (1600 parsecs) determines the number of stars counted in S. A. 64. It suggests an agglomeration at 300 or 500 parsecs, of which it is the outer slope.

In my paper „The distance of the Milky Way" (*M. N.* **79**) Table I, p. 501 log N_m (N_m being the total number of stars pro square degree down to magnitude m) is given for the Cygnus bright patch from the 6th to the 15th magnitude. While the sudden increase for the faintest class shows the effect of the remote starcloud, the number of brighter stars may be used to find the density at smaller distances. By plotting these log N we deduce from them $\log A = 9.56$, 0.17, 0.74, 1.25 for $m = 6.5$, 7.5, 8.5, 9.5 respectively; they can be represented by

$$\log A = 0.46 + 0.56\ (m - 8) - 0.025\ (m - 8)^2$$

and they give the density

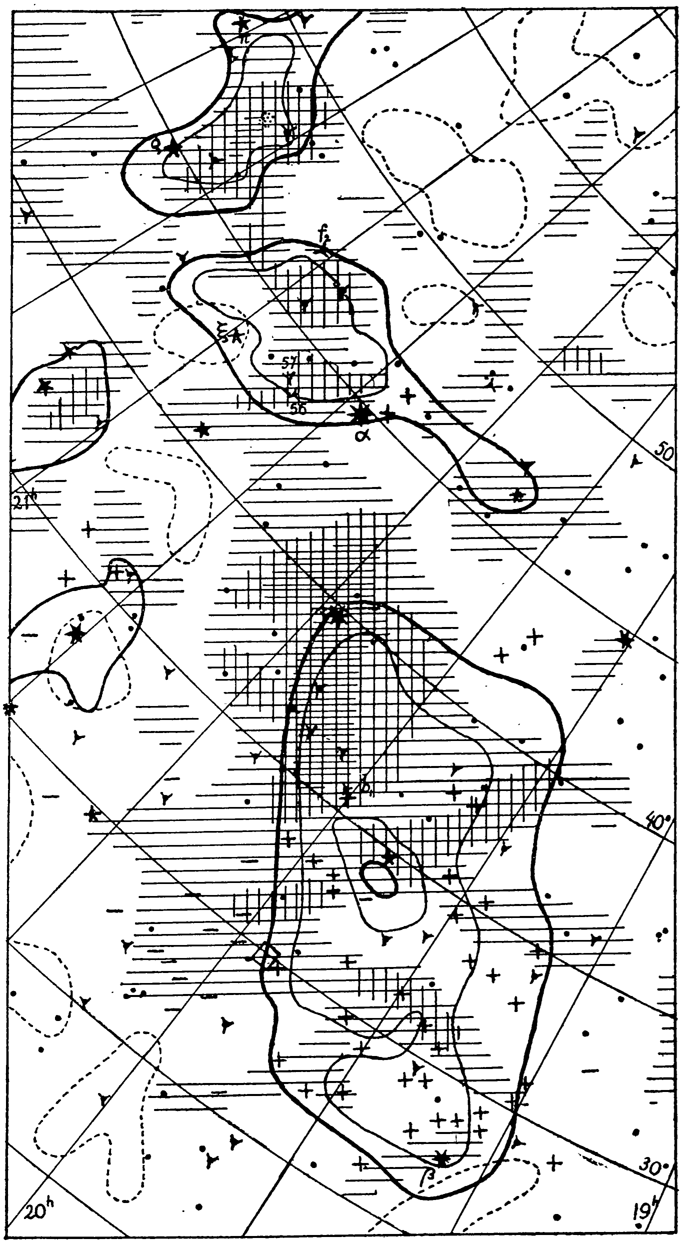
$$\log \Delta(\rho) = 0.16 - 0.04\ (\rho - 13.4) - 0.091\ (\rho - 13.4)^2.$$

The densities computed by this formula and the preceding one are

for ρ	12	13	14	15	16
or r (parsecs)	250	400	630	1000	1600
log Δ	0.04	0.16	0.10	(9.86)	
„ ($S\,A$ 64)			9.98	9.74	9.50

These results show, that in the direction of Cygnus an agglomeration of stars is situated at a distance between 200 and 600 parsecs, with density 1.5 times the density in the vicinity of the sun.

This agglomeration has nothing to do with the bright Cygnus cloud shown in drawings of the Milky Way. For the number of stars in the faint regions to the East of the cloud (given in the same Table I under the head „Cygnus, faint region") is hardly smaller than in the bright patch, down to the 12th magnitude, and yields nearly identical results for the agglomeration at 400 parsecs. While, however, in these faint regions the increase of log N becomes steadily slower for the faintest stars, in the bright patch the Herschel stars show a faster increase, the first effect of the remote starcloud. That in S. A. 64 nothing is seen of such a stronger increase, becomes



intelligible by an inspection of the magnificent Lick photographs taken by E. E. Barnard (*Public. Lick XI.*) On Plate 75 we see, that the field covered by S. A. 64 occupies a space with dark background, while in the immediate vicinity to the West small nebulous clouds are shown, where Herschel counted high numbers.

The extension of the Cygnus agglomeration may be studied by the distribution of the bright stars. In the diagram the distribution of the B. D. stars, down to 9.05, is shown; the shaded areas have a density > 10 pro square degree (the mean value for the galactic zone is 7.0), the doubly shaded areas > 12.5, the darkest areas > 15 (the dotted curves surround poor spaces < 7.5.) Though showing many irregularities the agglomeration appears in the main as a flattened mass of stars with a greater extension in the galactic plane than perpendicular to it. Its densest core lies round about γ Cygni and the stream of bright stars proceeding from it to b_1 Cygni. The star γ Cygni is a giant star of absolute magnitude -8 (for $\pi = 1.''0$) situated at a distance of about 100 parsecs (ADAMS and others *Aph. J.* **53**, 83), and is thus situated at the inner slope of the agglomeration. (Such giant stars in the midst of it must appear as stars $4^m - 6^m$.) The coarse cluster *M* 39 near ρ Cygni may be a small strong condensation in its eastern end.

Comparing the outlines of this agglomeration with the distribution of the bright galactic light, represented in the diagram by a strong and a thin line, denoting brightness 3 and 4 (after Plate VII in „Die nördliche Milchstrasse", *Annalen Leiden*, XI, 3) we see at once that it is wholly different from the galactic cloud between β and γ Cygni. This cloud extends farther to the West and South-West and has some of its brightest parts outside of the shaded area; the agglomeration extends farther to the East over very faint regions. Probably the densest agglomeration between γ and b_1 Cygni contributes an appreciable amount to the galactic light here; the Lick photographs also give the impression, that this region is composed of coarser stuff, i. e. of brighter stars, while the western parts consist of finer stardust and more irresolvable nebulous background. The gauges of Herschel are inserted in the figure by + if they are above, by − if they are below 150; the high numbers coincide with the galactic cloud. A small square indicates S. A. 64.

So it appears that the region of Cygnus has a more complicated structure than would be expected at first sight. Different formations are situated in this direction at different distances, which are seen partly projected upon each other, and combine their effects in the galactic light. Within our local starsystem, roughly at 200–600 parsecs, we have a somewhat flattened agglomeration. Whether it may be considered as a central condensation of this system, cannot be decided here. KAPTEYN supposes, that the two star streams may originate from rotational movements about the centre of the system; and he remarks, that in this case the centre must be situated at 90° from both vertices in the Milky Way, i. e. in the direction of Cygnus.

Through this agglomeration we see, partly behind it, the distant gigantic starcloud, that appears to us as the bright galactic patch β–γ Cygni. Its distance, however, seems to be given somewhat too great in our former paper. This distance depends on the adopted star density of the foreground (taken there equal to the density in high galactic latitudes) and the adopted density of the cloud (the constant adopted there giving a surface brightness 0.20). Now it has been remarked there already, that a denser foreground (corresponding to $b = 20°$) would cause a smaller distance; a density corresponding to $b = 0°$ may be still nearer to the truth. Furthermore the measures of VAN RHIJN, giving 0.10 for the surface brightness of the brighter galactic patches, show that the constant adopted for the star cloud must at least be halved; this causes a change in the same direction. By the new suppositions we find the minimum of $d \log N/dm$ to occur for $\rho = 21$ (called 16 in the former paper) at magnitude 11.2, for $\rho = 22$ at 12.2; for a minimum found at 11.5^m this gives $\rho = 21.3$; so the distance of the starcloud in stead of 40 000 becomes 18 000 parsecs.

As a third feature determining the distribution of the stars and the galactic light we must add absorbing nebulous masses. The dark spaces shown on Milky Way pictures about ξ Cygni and between ρ and π_2 Cygni appear also clearly in the D. M. stars (see the diagram), and on photographs they bear wholly the character of dark nebulae, that must be situated therefore between us and the Cygnus agglomeration. Also the great black spot (the northern coal-sack) *N* of f_2 Cygni and the rift proceeding from it between *f*–*A* and *g*–ρ Cygni, especially its bridges and its holes, are shown by the D. M. stars, and they may have the same origin, Otherwise it seems to be, however, with the region about 56–57 Cygni, showing bright galactic light in visual observations (which may, however, partly be subjective, as with a field glass this part is faint, cf. „Die Nördliche Milchstrasse", sketch on p. 15) and having a great density of D. M. stars. Here the photographs show a dark background; this may simply mean an empty space at a great distance besides the dense cloud, shown in MAX WOLF „Die Milchstrasse", Fig. 43. If however this darkness, as WOLF suggests, is caused by a dark nebulous mass connected with the America nebula, the absorbing matter must be lying behind the Cygnus agglomeration.