The period variation in velocity is not always present and that the star is not, at present, to be regarded as a bona fide binary. Perhaps the variation recorded by Hill and by Miczaika represents some effect of rotation. Miczaika correctly remarks that the period of 0.9 day is consistent with the period derived from the widths of the $He$ I absorption lines.

This result does not invalidate previous conclusions regarding the existence of very close systems in which $r_2 < r_1$. We know that a few such systems exist, and we must try to find more of them.

O. Struve

Berkeley Astronomical Department
University of California
September 4, 1951

The Milky Way from Sagittarius to Cepheus in the Infrared

A plate of the Milky Way in the photographic infrared has been taken with the Greenstein-Henyey wide-angle camera and is reproduced by Figure 1 (left). This exposure, obtained on a hypersensitized Eastman I-N plate behind Corning 5850 and Corning 2403 filters, includes the spectral range $\lambda 7200-8800$ and extends from Sagittarius to Cepheus. It was taken on July 7, 1951, with an exposure time of $1\frac{1}{2}$ hours. A comparison exposure, taken without filter on a 103a-F3 plate, including the spectral region $\lambda 3800-6800$, is shown in Figure 2. This plate was taken on July 6, 1951, with an exposure time of 20 minutes.

As has been emphasized many times, especially by Stebbins and Whitford, the decrease in absorption of interstellar matter toward longer wave lengths makes infrared radiation much more effective for space penetration than ordinary photographic or visual light. If we take the effective wave lengths for the I-N and 103a-F3 plates as approximately $\lambda 8000$ and $\lambda 4800$, respectively, we find from Whitford's interstellar absorption-curve that the total absorption, $A$, at these wave lengths, expressed in terms of the color excess $E_r$, is about $A_{\lambda 8000} = 3.2E_r$ and $A_{\lambda 4800} = 7.2E_r$, respectively. In addition, the N plate is more sensitive to the light of the population II red stars, which are strongly concentrated toward the galactic center, while the F3 plate is more sensitive to the light of the nearer blue stars and emission nebulosities of the Milky Way. For both these reasons the infrared plate gives a better picture of the over-all structure of the more distant regions of our galaxy.

In the infrared plate the dark rift in the Milky Way runs all the way through the galactic bulge, with approximately the same width everywhere. It should be noted that the galactic bulge mentioned here refers to the large bright area, about $18^\circ \times 30^\circ$ in size, near the southern limit of the illustration, corresponding to the central bulge seen in edge-on spirals. The galactic bulge investigated by Stebbins and Whitford at $\lambda 10,300$ is a much smaller, more highly concentrated area, about $3^\circ 5 \times 8^\circ$ in size, lying in the middle of the rift at $l = 326^\circ 5$. On the infrared plate the two sides of the Milky Way have more nearly equal surface brightnesses than on the panchromatic plate, not only at the galactic bulge but also farther north, where the west side is filled in with radiation. The structure of the rift is much more regular and sharply defined in the infrared ex-

Fig. 1.—Left, infrared wide-angle photograph of the Milky Way from Sagittarius to Cepheus; right, Mount Wilson photograph of NGC 891.
Fig. 2.—Panchromatic wide-angle photograph of the Milky Way from Sagittarius to Cepheus
posure, especially in the region of the galactic bulge. All the differences between the infrared and the panchromatic plates are those associated with, on the one hand, great space penetration and averaging of absorption over large distances and, on the other hand, lower space penetration and more pronounced effects of the near-by dark clouds.

In addition, there is a very rapid decrease in surface brightness of the Milky Way from the galactic bulge northward on the infrared plate; this effect, though present, is much less marked on the panchromatic exposure.

Attention should be called to the strong diffuse illumination near the southern horizon in the infrared photograph, which does not appear on the panchromatic exposure. As Dr. A. B. Meinel has pointed out to us, this shows the great strength of the infrared airglow emission spectrum.

For purposes of comparison, Figure 1 (right) shows a reproduction of a plate taken at Mount Wilson of the edge-on extragalactic nebula NGC 891. This illustration has been cut to show a little more than half the nebula, corresponding to the part of our galaxy that is shown by the wide-angle plate. The similarity between the two photographs is striking; in the two cases the galactic bulge and the dark rift of constant thickness appear quite analogous. Also, the steep gradient of light from the center of the galaxy out to the edge shows well in both plates, even though part of this effect is lost in NGC 891 because of the fact that the central bulge is burned out. As the position of the sun is well outside the bright central regions of our galaxy, the analogy between the two illustrations is valid.

We wish to express our sincere thanks to W. W. Morgan, who has helped us in all stages of this work.

Donald Osterbrock*
Stewart Sharpless
Yerkes Observatory
August 15, 1951

ON AN INTEGRAL EQUATION OF CHANDRASEKHAR AND MÜNCH

Recently Chandrasekhar and Münch derived an integrodifferential equation for dealing with the problem of the fluctuations in brightness in the Milky Way. In this note we shall obtain their equation more directly by a simple reformulation of their problem, which at the same time relates it to the general theory of continuous stochastic processes.

Chandrasekhar and Münch considered the following problem: Given (1) that there is a deterministic contribution of amount βdr from the element of length dr, at t = τ (this is due to the stars occurring with a uniform distribution along t) to the intensity measured at t = 0; (2) that clouds occur with a Poisson distribution $e^{-a t} (a t)^n / n!$ in any element of length t, where a is the probability per unit t that a cloud occurs in any interval; (3) that a cloud has a transparency factor q (i.e., it reduces the intensity of radiation of the light of the stars immediately behind it by this factor), with a probability density $\psi(q)$ so that $a \psi(q) dq$ is the probability per unit t that radiation of a given intensity $\mu$ "jumps" to an interval between $\mu q$ and $\mu(q + dq)$. Given all this, what is the frequency function, $g(\mu, t)$, governing the probability with which an observer at the origin will

---

6 Taken with the 60-inch telescope at Mount Wilson, November 23/24, 1916; exposure time 7 hours 15 minutes. We are greatly indebted to Dr. I. S. Bowen, director of the Mount Wilson and Palomar Observatories, for permission to use this photograph.

* Atomic Energy Commission Pre-doctoral Fellow in Astrophysics.


© American Astronomical Society • Provided by the NASA Astrophysics Data System