to the equation:

$$\kappa = \frac{2\sqrt{2}\lambda^2 n^2 e^6}{3\sqrt{\pi}\mu c^3 (mkT)^{3/2}} \log_e \left(\frac{4kT}{e^2 \sqrt{2n}} \right)^2,$$

where κ is the absorption coefficient, λ the wave length, n the electron density, e the charge on the electron, c the velocity of light, μ the refractive index, m the mass of electron, k Boltzmann's constant, and T the temperature in degrees Kelvin. Following Martyn¹ the analysis of Lorentz, and Chapman and Cowling^{2,3} was used. The electron density distribution in the corona proposed by Baumbach⁴ and modified by Allen⁵ and Van de Hulst⁶ was used. In the chromosphere the electron density distribution is that proposed by Wildt.⁷ The temperature distribution used in the corona was that of Alfven.⁸ The effective temperature for any ray is shown to be

$$T_e = \sum_{r=1}^n (1 - e^{-\kappa_r \Delta h_r}) T_r e^{-\sum_{s=r+1}^n \kappa_s \Delta h_s}.$$

For the purposes of the computation the atmosphere is divided into layers where κ_r , Δh_r , T_r are the absorption coefficient, the thickness, and the temperature of the r th layer. Effective temperatures were computed in this manner for rays emerging at various positions from the center to the limb.

In order to obtain a fit with the experimental data on the effective temperature of the sun as a function of wave length, it is necessary to assign a new temperature distribution for the lower part of the sun's atmosphere. A good fit with the experimental data is obtained if the temperature is assumed to rise slowly from the boundary temperature of 4830°K at the photosphere to

10,000° at a height of 10,000 km and then to rise exponentially to a maximum temperature of 10⁶ degrees at a height of 25,000 km. This set of conditions in the solar atmosphere adequately explains the behavior of the quiet sun at short radio wave lengths.

1. *Proc. Roy. Soc. A*, **193**, 44-59, 1948.
2. *The Mathematic Theory of Non-Uniform Gases*, Cambridge Univ. Press, 1939.
3. *Proc. Roy. Soc. London* **183A**, 453-479, 1945.
4. *A. N.* **263**, 121, 1937.
5. *M. N.* **107**, 426-432, 1947.
6. *Ap. J.* **105**, 471-488, 1947.
7. *Ap. J.* **105**, 36-84, 1947.
8. *Ark. Mat. Astr. Fys.* **27A**, 25, 1-23, 1941.

Naval Research Laboratory,
Washington, D. C.

Hall, John S. and Alfred H. Mikesell. Observations of polarized light from stars.

More than 175 early-type stars have been observed with a photoelectric polarimeter attached to the 40-inch reflector at the U. S. Naval Observatory. This polarimeter was built at Amherst College, financed by the Research Corporation and described briefly in a paper presented at the Pasadena Meeting of the A.A.S.¹ The observational procedure is that outlined in a preliminary paper.²

A quarter-wave (4350Å) plate of mica was used to determine the nature of the light from HD183143. By changing the position angle of the mica we found that the polarized light could be reduced from 7 per cent to 0.7 per cent. Since no color filter was used, the residual effect may be produced by a difference in effective wave lengths. These preliminary measures therefore indicate that the light from HD183143 consists of plane-polarized and unpolarized components.

Figure 1. Vector diagram showing polarization of individual stars.

Our observations indicate that:

1. Stars of large color excess usually show polarization; in stars with zero or a negative color excess the polarization is less than one per cent.

2. Several groups of stars show considerable homogeneity (see Fig. 1) in the direction of their planes of polarization; this suggests that their light has passed through the same polarizing cloud or clouds.

3. Star HD109387 shows evidence of polarization despite its high galactic latitude of 48° .

4. There is some evidence of a progressive trend in the tilt of the vectors as one looks along the plane of the galaxy in either direction from Perseus ($l = 105^\circ$).

5. If these phenomena are due to selective scattering by magnetized particles, as proposed by Spitzer and Tukey,³ and by Greenstein and Davis,⁴ the vectors shown in Figure 1 should be parallel to the magnetic lines of force. Although there are many obvious exceptions, a general galactic magnetic field with lines of force perpendicular to the galactic plane is suggested by these data.

1. *A. J.* **54**, 39, 1948.

2. *Science* **109**, 166, 1949.

3. *Science* **109**, 461, 1949.

4. *Phys. Rev.* **75**, 1605, 1949.

*U. S. Naval Observatory,
Washington, D. C.*

Hall, R. G., Jr. Photographic blending of images of astrometric binaries.

The mass-ratio of a binary system is normally determined from a comparison of the absolute orbital motion of one or both components about the center of mass and the relative orbital motion of the two components. Binary systems with separations of less than about 0.15 mm on the photographic plate appear as a single blended image under normal conditions. In such cases it is only possible to measure the motion of the light-center of the blended image. Since the center of this image is situated closer to the center of mass than is the primary component it is necessary to apply a correction, which in the various investigations has been assumed to be

$$\beta = \frac{I}{1 + 10^{0.4\Delta m}}$$
 where Δm is the difference in magnitude between the components. The formula was derived from a consideration of the luminosities of the two components.

Experiments at the Yerkes Observatory with artificial double stars show that the blending is less than that given by the formula for binary

systems having magnitude differences of more than 2 and separations from 0.075 to 0.150 mm on the photographic plate. For separations less than 0.075 mm and for magnitude differences of less than 2 the formula is accurate. The deviations from the formula may be as much as 0.05 in β which would introduce an error of about 10 per cent in the mass-ratio.

These results are based on the Eastman Kodak Co. emulsion 103a-O. Similar investigations based on other types of emulsions are in progress.

*Yerkes Observatory,
Williams Bay, Wis.*

Haro, Guillermo. Faint spectra showing $H\alpha$ in emission in the obscuring clouds of Ophiuchus and Scorpius and in a region in Sagittarius.

Struve's¹ discovery of six T-Tauri stars in the nebulae in Ophiuchus and Scorpius has led the writer to photograph the same region with the Tonanzintla Schmidt using the 26-inch prism and emulsion 103a-E. From the first of April to the 25th of May of this year, six plates with exposures from 30 to 120 minutes were obtained with the center at $\alpha = 16^h19^m$ and $\delta = -26^\circ$, covering about 25 degrees square. All Struve's stars clearly appear on five of our plates, and star No. 22 of his list is the only one that does not show on the one of shortest exposure. Star No. 12 from the same list does not show $H\alpha$ in emission on any of our six plates, notwithstanding the different exposure times and different widths given to the spectra.

In the region observed 17 new objects were found with strong or very strong bright $H\alpha$, which, if added to the 6 already discovered, make a total of 23. Of these 23 objects 14 are apparently situated in the densest part of the cloud and are approximately of photographic magnitude between 12 and 16.5. The faintest spectra with $H\alpha$ in emission have been observed at least on two plates. The limiting photographic magnitude in this survey was determined with the aid of Greenstein's² photographic magnitudes in Messier 4.

Direct Schmidt plates with relatively long exposures and the Ross and Calvert Atlas of the Milky Way reveal that the stars with emission lines are situated in areas that apparently have different obscuring densities where the presence of faintly luminous nebulosities, probably of the reflection type, are easily observed. Of course, this apparent association may be an effect of projection. Incidentally, when observing Joy's³ bright-line stars in Taurus the writer noticed