to develop a wide-field photographic method to supplement the photoelectric observations being made by Hall with the 40-inch reflector.

A calcite crystal having a clear field of 2 by $2\frac{1}{2}$ inches was placed near the focal plane of the 26-inch refractor. Two images, O and E, separated 1.8 mm and polarized at right angles to each other were obtained. As the crystal was rotated through 360° the difference in intensity $I_O - I_E$ passed through two cycles. The relation is $(I_O - I_E)/(I_O + I_E) = P \cos 2(\gamma - \theta)$. P is the degree of polarization, γ is the position angle of the line joining O to E, and θ is that of the star's polarization vector. Two exposures, in theory, determine P and θ .

The photographic method is a differential one. The O and E images are made simultaneously, and errors due to timing, guiding, changes in seeing, passing clouds, and variations in plate background were found to be unimportant. Other systematic effects, however, can and did occur. To determine the usefulness of the method, a joint program was initiated in which independent measures were made photoelectrically by Hall and photographically by Markowitz.

When working on test stars multiple exposures were made in 8 rows, the camera being rotated 45° after finishing each row. As a final test the polarizations of HD 25090 and β Monocerotis were determined without prior knowledge of the photoelectric results. The close accordance obtained for both P and θ by the two methods convinced us that the photographic method is practical. No systematic differences have been found thus far in the results of the two methods.

The plates were measured in a photometer using a photomultiplier and a Brown recorder. A semi-transparent aperture permits simultaneous recording and viewing of the projected image. The p.e. of the difference in magnitude of a pair of images, based on 311 pairs on 13 plates of the clusters, is ± 0.025 for optimum exposure. The average over the measurable range, about two magnitudes, is about ± 0.035 . In general, four exposures determine P to $\pm$ one per cent.

Plates of the clusters h Persei and NGC 1502 were taken in sets exposed for 1, 10, or 30 minutes. Each set had two plates oriented at θ , at $\theta + 45^\circ$, and at $\theta + 90^\circ$, the value of θ being that found by Hall for the bright stars in the clusters. The faint stars were found to have

practically the same polarization as the bright ones. Stars hitherto classed as field stars have, in general, less polarization, possibly none. Although the diameter of NGC 1502 is often listed as $8'$ the unusually high polarization of 6 per cent has been found for a region $20'$ in diameter thus far. It is intended to study these clusters in detail and to make a survey of other galactic clusters for polarization.

In strong contrast to these extensive polarization fields is that of the triple star β Monocerotis (ADS 5107) in which $AB = 7''.3$, $BC = 2''.8$. The photoelectric method could measure A separately, but B and C had to be measured together. All components could be separated photographically, but the sharp clean images required led to photometric difficulties. Over 2000 exposures were made on 12 plates. The two methods agree that A is polarized 1.5 per cent at about 100° , but that B and C are much less polarized, 0.5 per cent or less. Additional studies of this interesting system are desirable.

The crystal used was loaned by the Bureau of Standards. We are greatly indebted to Dr. Irvine Gardner for his interest in these experiments and for the preparation of the crystal.

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Menzel, Donald H. and Hari K. Sen. Operational solution of the reflection effect in eclipsing binaries.

We have applied the operational method described in an earlier paper, hereafter referred to as Paper I,¹ to solve the Milne integro-differential equation for the diffuse radiation (I) in the plane-parallel atmosphere of a reflecting star:

$$\mu \frac{\partial}{\partial \tau} I(\tau, \mu) = I(\tau, \mu) - B(\tau), \quad (1)$$

where

$$B(\tau) = \frac{1}{2} \int_{-1}^{+1} I(\tau, \mu) d\mu + \frac{1}{4} Fe^{-\tau \sec \beta}. \quad (2)$$

The reflecting star is exposed to a parallel beam of radiation of flux πF per unit area normal to itself and incident at an angle β normal to the boundary of the atmosphere.

We have assumed the following expansion for $B(\tau)$:

$$B(\tau) = a + \sum_0^\infty A_j K_{j+2}(\tau) + \frac{1}{4} \gamma Fe^{-\tau \sec \beta}, \quad (3)$$

where $K_n(\tau)$ is the exponential integral of the