This research was supported by the Office of Naval Research.

1. *Special Report* No. 35, A.M.C. Contract W 19-122ac-17, 1951.
2. *A. J.* **117**, 313, 1953.
3. *Pub. Dom. Astroph. Obs.* **7**, No. 26, p. 395.

*Princeton University,
Princeton, N. J.*

Smith, Elske v. P. and Henry J. Smith. Distribution of M and carbon stars in the southern Milky Way.

With the ADH telescope and objective prism, infrared spectrum plates have been obtained covering a band 3° wide along the galactic equator between longitudes 180° and 360° for the purpose of detecting and studying the distribution of M-type stars and carbon stars. Fifteen supplementary centers at latitudes $+2^\circ$ and -2° were included to smooth out the effects of irregular absorption. This survey is partly an extension of a survey carried out by Nassau, Blanco and Morgan, in the north.¹

Spectral classification has been based on stars classified in the LF 3b field in Cygnus by Nassau and van Albada,² as well as on short exposures of stars in the Mount Wilson Catalogue of Spectroscopic Parallaxes.³ The limiting infrared magnitude of the survey is probably a little fainter than ten.

A total of 2186 stars of spectral type M 5.5 and later were found, of which fourteen were previously known. New carbon stars numbering 165 were discovered, as well as four previously known. As observed in the northern hemisphere, the distribution of M stars discloses nearby local obscuration and a general decrease in density towards the anticenter. The number of M stars per square degree increases with small fluctuations from 1.1 at longitude 185° to 7.2 at 300° . The density then falls off due to the great rift in Scorpius-Sagittarius. The C stars, on the other hand, reach a maximum of 0.5 per square degree at longitude 215° , not far from the Carina aggregate of Type I objects, and then drop off gradually. This observed difference in distribution tends to confirm the suggested assignment of M stars to population Type II and the C stars to Type I.

1. *A. J.* **57**, 21, 1952.
2. *Ap. J.* **109**, 391, 1941.
3. *Ap. J.* **81**, 187, 1935.

*Boyden Station,
Harvard College Observatory,
Bloemfontein, South Africa.*

Smith, Henry J. Nova Tucanae, 1952.

On a blue spectrum plate on the Small Magellanic Cloud made with the ADH telescope on December 21-22, 1952, there appears a spectrum typical of a nova. Data obtained from direct photographs indicate that this object is a nova that reached maximum on December 19-20, 1952, and fluctuated rapidly between magnitude 11.0 and 11.5 on that night. This maximum magnitude is in accord with previous Small Cloud novae. The nova faded at least 7.5 magnitudes in nine months, which is characteristic of a fast nova.

The spectrum on the discovery plate greatly resembles that of Nova DQ Herculis on December 13, 1934, which is reproduced in Stratton's Atlas. The Balmer lines $H\beta$ through $H8$ are broad and diffuse, with intense broad emissions on their red edges. In addition, several weak emissions may be present, particularly HeI 4027 and 4471, $MgII$ 4481, and $HeII$ 4686 or CII 4650. McLaughlin remarks that the premaximum emission spectrum of DQ Herculis is unique among novae. Although the spectrum discussed here was made two days after maximum, the similarity to Nova Herculis is striking. One might suggest that this new nova is a second example of a premaximum emission spectrum, which has persisted somewhat longer than in the case of DQ Herculis.

*Boyden Station,
Harvard College Observatory,
Bloemfontein, South Africa.*

Strömgren, B. Spectral classification through photoelectric photometry in narrow wavelength regions.

In continuation of previous investigations on spectral classification through photoelectric photometry with interference filters a method of two dimensional classification of B, A and F stars based on measures of the strength of $H\beta$ and of the Balmer discontinuity has been developed.¹

An index measuring the strength of $H\beta$ is determined with the help of interference filters with maximum transmission at 5000Å, 4861Å, and 4700Å, respectively, while measures through filters with maxima at 4500Å, 4030Å, and 3550Å yield an index measuring the Balmer discontinuity. Both indices are practically uninfluenced by interstellar reddening. The half-width of the $H\beta$ filter is 35Å, the other filters have half-widths around 100Å.

Measures were made with a photoelectric photometer attached to the 82-inch reflector of the

McDonald Observatory in November and December, 1951, February and March, 1953, and November, 1953. The method was calibrated by measures of about one hundred stars for which accurate spectral classes and luminosity classes by W. W. Morgan were available. The agreement between the two sets of classifications was very satisfactory.

For about seventy F stars, of photoelectric $B-V$ color, indices measured by H. L. Johnson, D. Harris, and by P. Naur at the McDonald Observatory were available. For most of these stars interstellar reddening should be very small so that the accuracy of prediction of intrinsic colors from the measured $H\beta$ and Balmer indices could be tested. The photometric probable error of a predicted $B-V$ value of one observation is ± 0.006 mag. This corresponds to a probable error ± 0.02 of a spectral class. The comparison between observed and predicted $B-V$ values indicated that cosmical scatter was small, of the order of ± 0.006 mag. or less.

The photometric probable error of one observation of a predicted absolute visual magnitude for an F star was found to be ± 0.18 mag. Comparison with absolute magnitudes from spectroscopic and trigonometric parallaxes gave no indication of cosmic scatter.

For the B stars the predicted absolute visual magnitude depends practically only on the $H\beta$ index. The photometric probable error of one observation was found to be ± 0.12 mag. Comparison with spectroscopic absolute magnitudes determined by W. W. Morgan indicated no cosmical scatter. An upper limit only could be determined, viz. ± 0.2 mag.

Photoelectric photometry with interference filters (K line, g discontinuity and cyanogen criteria) of about 250 K stars, carried out by Mr. K. Gyldenkrne with a 10-inch reflector of the Copenhagen Observatory, confirmed the results obtained earlier that two dimensional classification is possible here also. The agreement with classification obtained by W. W. Morgan and by Miss Nancy Roman is satisfactory. Comparison with color indices measured by D. Harris indicated that for K giants the intrinsic color can be predicted from the K-line criterion with a probable error of one observation about ± 0.012 mag.

Simultaneous photoelectric photometry with photon counters of three narrow wave-length regions, $H\beta$ and two comparison regions, defined through slits at the cou spectrograph focus of the 82-inch reflector of the McDonald Observa-

tory, have been carried out. The experience gained indicates that it will be feasible and advantageous to develop the classification method in this direction. What is required of the spectrograph is fairly high angular dispersion, so that the wave length regions are sufficiently well-defined even with a slitless arrangement. While the interference filter method used with the 82-inch yields high precision down to about 12 mag., simultaneous measures would extend the range of application to about 14 mag. For equal precision the gain over the photographic method is about 4 magnitudes when the photoelectric accumulation time is equal to the photographic exposure time.

1. B. Strmgren, *A. J.* **56**, 142, 1951.

*Yerkes and McDonald Observatories,
Williams Bay, Wis.,
and Fort Davis, Tex.*

Whitford, A. E. Observational tests for intergalactic matter.

The observation that distant spiral galaxies are not reddened¹ is evidence against appreciable selective absorption in intergalactic space out to about 100 million parsecs. A gas-dust mixture like that in the solar neighborhood of density 10^{-29} g/cm³ would produce an intergalactic color excess of about 0.10 mag. in such a path length. According to the Oort-van de Hulst analysis,² however, solid particles would be very unlikely in intergalactic space since the required density for condensation exists only inside galaxies. Rayleigh scattering by gas alone would require impossibly high densities to produce detectable reddening. Zwicky's suggestion of absorption effects on background nebulae seen through a cluster of galaxies is not a general test,³ since such a region could show an accumulation of intergalactic gas and dust stripped from spiral systems by the Baade-Spitzer collision mechanism.

Detection of a purely gaseous intergalactic continuum by line absorption is complicated by the red shift. A shallow line whose depth is independent of path length would be expected. For NaI and CaII , a density of the order of 3×10^{-13} atoms/cm³ would produce a 5 per cent depression. If all of the atoms of either type were in the favorable state of ionization, cosmic abundance ratios would set a limit of detection of 5×10^{-31} g/cm³ for the total density. The latter figure is of the same order as the revised value of the smoothed density of nebular matter.

A study of ionization equilibrium is handicapped by uncertain knowledge about the radia-