

RED AND BLUE STARS IN THE DIRECTION OF THE LARGE MAGELLANIC CLOUD

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SUMMARY

The Large Magellanic Cloud has been surveyed on ultra-low dispersion ($10,000 \text{ \AA mm}^{-1}$) plates taken with the 102 centimeter reflector at Kavalur. Many new red and blue stars were found. The LMC Bar was found to have a strong component of red stars and a very weak component of faint OB stars. In general the regions other than the bar contain very luminous OB stars, faint OB stars and a few very red stars. The 30 Doradus complex is rich in luminous red and blue stars.

1. INTRODUCTION

Study of the stellar content of the Large Magellanic Cloud is of fundamental importance to the understanding of stellar and galactic evolution. The determination of the relative number of blue, yellow, and red supergiants in clusters, associations and in the field will be of use in understanding the evolution of massive stars. From the objective prism surveys of Sanduleak (1970), Fehrenbach and Duflot (1970), and Westerlund (1960) a large number of LMC bright stars have been catalogued. In objective prism surveys, if one decreases the dispersion one can reach fainter stars and the crowding due to overlapping spectra can be reduced, but one loses information concerning each star. One must select features that are recognizable at very low dispersion. The use of ultra-low dispersion was first successfully employed by Morgan *et al.* (1954). At a dispersion of $30,000 \text{ \AA mm}^{-1}$ they were able to detect highly reddened OB stars

in the VI Cygni association. Schulte (1956) employed this technique to identify new members of the VI Cyg association. More recently Bappu and Parthasarathy (1974, 1977) examined the ultra-low dispersion ($10,000 \text{ \AA mm}^{-1}$) technique in greater detail to study stars and galaxies.

2. OBSERVATIONS

We have employed an $f/2$ slitless spectrograph with a three degree quartz prism and a Schmidt camera at the Cassegrain focus of the 102 cm Ritchey Chretien reflector at Kavalur. The field is $40'$ in diameter. Spectra covering the wavelength range 3500 \AA to 6600 \AA were obtained on Kodak 103a-E emulsion. The dispersion is $10,000 \text{ \AA mm}^{-1}$. The spectra are unwidened and are about 250μ in length along the dispersion. From our initial survey of the 30 Doradus region (Bappu and Parthasarathy 1977), we found that this technique is undoubtedly a promising way to work to much fainter magnitudes and to detect blue and red stars in LMC. Now we have completed the survey of the regions around 30 Doradus and several regions along the bar and north of the bar.

3. CLASSIFICATION

The principal criterion for classification is the shape of the stellar spectrum and also the density in different portions of the image. Ultra-low dispersion spectra of different kinds of objects are shown in Fig. 1. On our LMC plates we have identified the stars classified by Sanduleak (1969) and Westerlund (1960) to calibrate our classification. The classification criteria are checked with the ultra-low dispersion spectra of our stars in NGC 2362 and h and χ Persei. When we compare our ultra-low dispersion technique with multicolor photographic photometry we find that the ultra-low dispersion spectra contain a number of significant information bits and in addition we have the advantage of exposing all parts of the spectra simultaneously for a large number of stars, with consequent saving of time.

4. RESULTS

From our survey we have detected a large number of new OB stars and red stars. The density of luminous OB stars is much higher in the LMC clusters and associations than in galactic ones. Luminous red and blue stars are very numerous near the 30 Doradus complex, but the red stars avoid the regions rich in gas and H II regions. In general the regions other than the Bar contain very luminous OB stars and also faint OB stars, and a few red stars. Stars of intermediate spectral type are not common.

In the LMC bar region the number of red stars in the magnitude interval 14-16 is low. There is a strong component of fainter red stars. From a study of two color composite photographs of LMC Walker *et al.* (1969) concluded that the Bar contains mostly Population II red stars. We find that in the LMC Bar the number density of stars of intermediate spectral type in the magnitude interval 16-18 is very low. Few faint OB stars (~ 16-17 mag) are seen in the bar.

Most of the blue stars and very red stars are obviously LMC members. A large percentage of faint stars of intermediate spectral type could be foreground stars. The presence of a strong component of red stars in the Bar of the LMC indicates that the earliest generation of stars were formed in the Bar. Tifft and Snell (1971), from a study of color-magnitude diagrams of the Bar regions, also find a very old component and also stars of intermediate ages.

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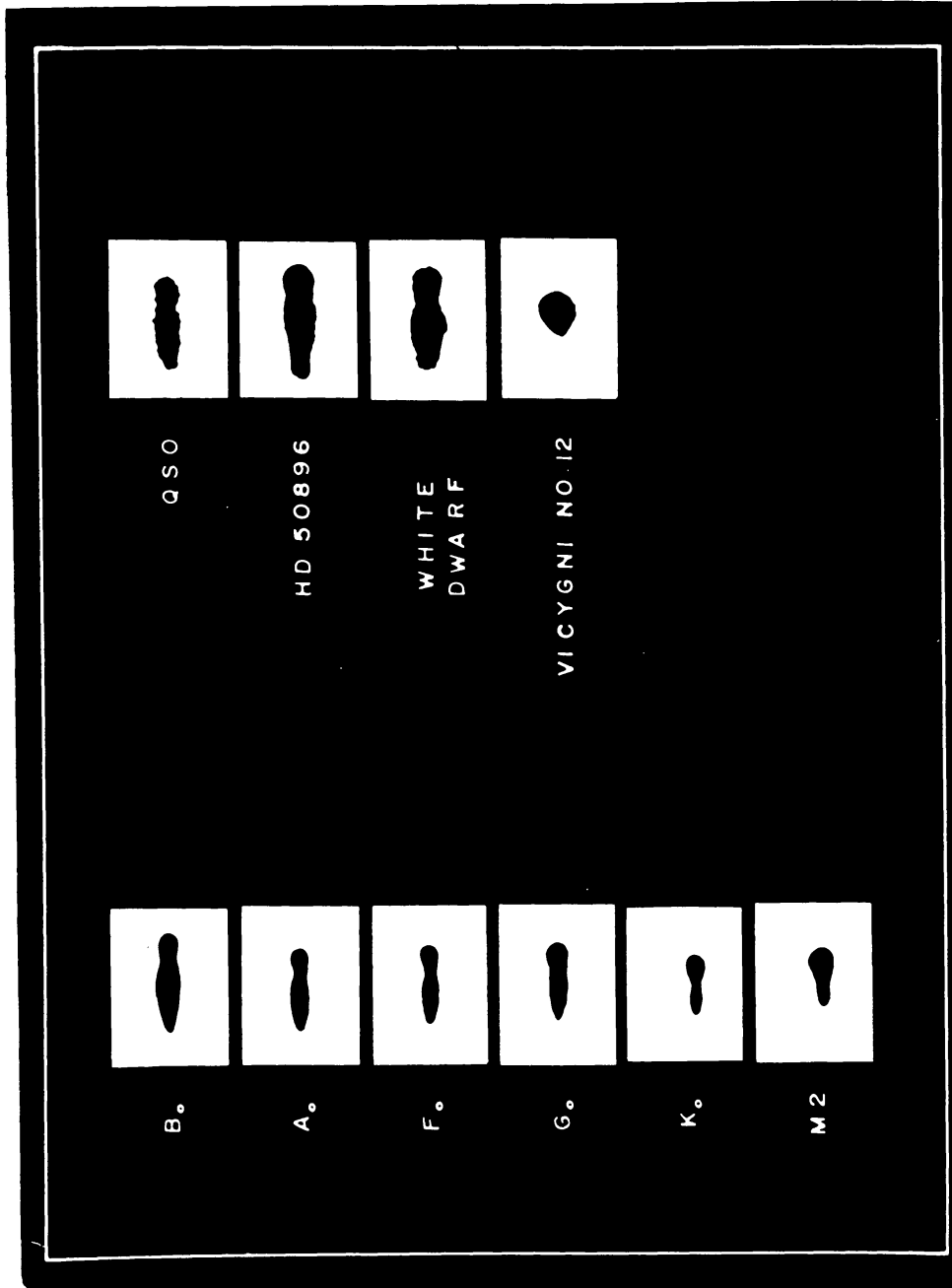


Fig. 1. Ultra-low dispersion spectra of different kinds of objects. Longer wavelengths are to the right. The discontinuity in the spectrum is due to the dip in the sensitivity of the 103 a-E emulsion in the green region.