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POSITIONS, SPECTRAL IDENTIFICATIONS, AND NEAR INFRARED PHOTOMETRY FOR A COMPLETE SAMPLE OF RGB AND AGB STARS ON THE GALACTIC PLANE TOWARDS CARINA

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A deep near-infrared objective-prism survey for AGB stars in Carina has been carried out. An area of about 20 square degrees centered on l = 290°, b = 0° was covered to *I*= 13. The identified sample is made of 636 RGB stars of spectral type M5-M9. A sample of AGB stars was also identified, among them 46 N-type carbon stars, and 6 S-type stars. Additionally, 14 red supergiants were also identified. Accurate positions, spectral types and IRAS identifications are given for this sample. The number ratio [C/M5+] in the disc, toward the observed region, was determined giving a value of 0.1-0.2 stars/kpc^3, consistent with previous results. A catalog with precise positions, MK spectral types, and infrared I, J, H, and K magnitudes for all the stars in the sample is presented. Cross identifications, where possible, with IRAS and 2MASS catalogs are also given.

1. INTRODUCTION

The aim of this study is to determine the relationship between the space distribution of RGB (Red Giant Branch) stars, represented by the late-type M giants stars, and AGB (Asymptotic Giant Branch) stars, basically cool carbon (N-type) stars and S stars, in the galactic plane. M stars represent the so called oxygen-rich late-type stellar population in the galactic disk. AGB stars are evolved objects of low effective temperature and high luminosity, and represent a stellar population in an evolutionary stage between the RGB and and white dwarfs. Interest in the space distribution of Asymptotic Giant Branch (AGB) stars has grown primarily because it is believed they are relevant to our understanding of the process of the late stages of stellar evolution and the formation, evolution, and dynamics of star systems. During the AGB phase a star can lose a significant amount of its initial mass, surrounding itself with a circumstellar envelope (CSE) which at times may be dense enough to preclude the observations of the star in visible light (Jura & Kleinman 1989). The M, C and S stars together represent the largest fraction of known AGB stars, and they are found mainly in the galactic disk. However, a marked difference exists in the galactic distribution of M, particularly the M5 type or later (M5+) stars and the cooler C stars, in the sense that the number density ratio [C/M5+] is not constant throughout the galactic disk but increases toward the outer regions of the Galaxy. This is contrary to what would be expected from the evolutionary relationship between these types of stars (Blanco 1965, 1989; Fuenmayor 1981).

In this paper we present the results of a deep search for RGB and AGB stars in a region towards Carina at l = 290°. This is part of a project to survey selected regions along the galactic plane in order to determine accurate positions, spectral types, and IRAS, Hipparcos, and Dennis identifications for the observed stars.

2. OBSERVATIONS

2.1. *Spectral Identifications*

The region surveyed covers an area of 20 square degrees centered at R.A. 11h 10m and DEC -61° (2000), with galactic coordinates l = 290° and b = 0°. Two Schmidt objective-prism plates, one deep and one shallow, were secured with the CTIO Curtis Schmidt telescope. The telescope-prism-emulsion combination gave a dispersion of 1700 Å/mm at the telluric A band.

The plates were scanned with a a Zeiss binocular microscope to identify the very red stars and determine their magnitudes and spectral types. The magnitudes are a photographic *I* estimated from the densities of the spectral images. The spectral types are on the Case system (Nassau & Velghe 1964) and were determined to one-half spectral type, using the $\lambda\lambda$7054, 7589, 8300, and 8432 Å TiO bands for M stars and the $\lambda\lambda$7945, 8125, and 8320 Å CN bands

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for carbon stars. The early M stars (spectral type < M5) identified during the search were withdrawn from the sample due to strong contamination by hotter foreground stars.

2.2. *Positions*

The positions of the identified stars were determined by measuring the xy coordinates of the A band in the spectra with a Zeiss PSK two-coordinate measuring machine and computing equatorial coordinates using the concentric plate-projection method of Stock (1981) and reference stars from the PPM catalog. Positions have mean a error of about $1''$.

2.3. *Photometry*

Photographic infrared I magnitudes were estimated for all the stars from the spectrum density on the objective-prism plates. The derived positions were used to obtain cross identifications with infrared sources in the IRAS Point Source Catalog, the 2MASS All Sky Survey, the Hipparcos Catalog, and the Dennis Survey. JHK photometry was obtained from the 2MASS All Sky Data Release catalog for 248 M stars, and 16 carbon stars.

3. THE CATALOG OF THE OBSERVED RGB AND AGB STARS

This survey has identified 695 late-M stars, 24 carbon stars, 6 S stars, and 12 late-type supergiants in a direction toward Carina. A catalog with the astrometric, infrared photometric and spectroscopic properties for all the stars found on the survey is available upon request from the first author.

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