# A LOW-DISPERSION, NEAR-INFRARED SURVEY FOR GALACTIC M SUPERGIANTS

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## I. Introduction

While there have been many surveys for luminous, blue galactic stars and their numbers can be considered somewhat complete, such is not the case for red supergiants (see e.g. Humphreys and McElroy 1984). One result of this incompleteness is that the ratios B/R and WR/R, often used as diagnostics for evolutionary models of massive stars and the variation of the ratios with galactocentric distance, are not well known for the Galaxy. In an attempt to improve the statistics, the first author began an objective-prism survey within 6 deg of the southern galactic plane using I-N plates. The dispersion is 3400 A/mm at the A-band, and the spectra cover the range 6800-8800 A; the deepest plates reach ir mag ~13. The detection of possible M supergiants on such plates was first discussed by Nassau, et al. (1954) and depends on the presence of TiO at 7054 A and a spectrum sharply tapered to the blue. For supergiants, this shape results from integration of interstellar dust over a long path-length, but any sample of red stars with tapered spectra contains M giants in heavily-obscured regions and S stars; thus follow-up observations of the candidate stars are necessary.

## II. Status of survey

To date, all plates on 33 centers (596 sq deg) have been searched and several hundred candidate stars have been marked, however only those on 74% of this area have had coordinates determined and thus are available for follow-up observations. The plates searched are in two regions of nearly equal area: A: $208 \leq$ long $\leq 248$ (224 sq deg) and B: $288 \leq$ long $\leq 304$ (219 sq deg); the number of known M supergiants in these regions are 3 and 31, respectively (Egret 1980).

## III. Follow-up observations

A. Eight-color photometry. In March 1984 we began a program of 8-color measures in Wing's system (Wing 1971) which White and Wing (1978)



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have shown to be effective for the classification of red supergiants. The observations, made at Cerro Tololo, are continuing, and over 100 program stars have been measured; however, to date, only measures for 39 candidates in region B have been reduced. The photometry indicates that nearly 50% of the best candidates are new K/M supergiants.

B. CCD spectroscopy. In March 1985 we obtained CCD spectra of 57 program stars in both regions and of 31 revised MK standards of later type. The spectra cover the range 6362-8842 A at a resolution of 8 A. Several approaches have been employed to classify the program stars using the PANDORA/ROO package of programs (developed at Mt. Stromlo and set up by S. Simkin). Spectral types were determined by quasi-photometry of the digital spectra using the band-passes of Wing's filters 1 and 2. Similar photometric and equivalent-width measures of features known to be luminosity-sensitive in late-type stars were made: the Ca II triplet (Jones, et al. 1984), Fe I 8688.6 A (Humphreys 1971), and the (0,2) CN-band system in the region 7870-7970 A (Sharpless 1956). None of these indicators is ideal; there are some inconsistencies among them, and the assignment of divisions within class I is more difficult than in the blue region as Humphreys (1971) stated. We have also experimented with pixel-by-pixel division of the spectra of program stars by those of the standard stars and with a correlation method, but the spectra are too noisy for effective use of these techniques.

## IV. Summary

We have classified 27 new, red supergiants in an area of 443 sq deg along the southern galactic plane where 34 M supergiants were previously known. Most of the new stars are in the range $11 < V < 15$, and the faintest suffer 5 or 6 mag of visual absorption. We are continuing the survey over the remainder of the plates available (1700 sq deg) and will pursue follow-up observations. We expect to about double the number of late supergiants.

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