Wolf-Rayet Phenomena in Massive Stars and Starburst Galaxies
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A 2μm narrow-band survey for emission-line stars in the inner Galaxy

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Abstract. We have begun a search for emission-line stars toward the inner Galaxy using narrow-band photometry centered on the emission lines of He I 2.06μm, C IV 2.08μm, H I Brγ 2.166μm and He II 2.189μm. The census of Wolf-Rayet and other emission-line stars in the Galaxy is incomplete, owing to the large extinction at optical and shorter wavelengths toward the inner Galaxy. However, these massive, evolved stars are bright and can be detected at large distances in the near infrared.

1. Introduction

Wolf-Rayet stars represent a very young population ($\sim 10^6$ yr) and hence are useful in tracing recent star formation. Their relative numbers among different sub-types can be used to constrain stellar evolution theory, trace Galactic structure, and perhaps to understand chemical enrichment as a function of Galactic position (and thus Galactic evolution, van der Hucht *et al.* 1988; Conti & Vacca 1990). WR stars and related objects are bright and hence can be seen to great distances in the near infrared. A census of the relative numbers of such stars is important for studying the initial mass function in star forming regions (Parker *et al.* 1993; Massey *et al.* 1995). In spite of this great utility, the census of emission-line stars is seriously incomplete toward the inner Galaxy due to the large extinction at UV and optical wavelengths by intervening dust. The sample is reasonably complete only to about 2.5 kpc from the Sun (Conti & Vacca 1990). Current understanding of the near-infrared spectra of emission-line stars presents an excellent opportunity to systematically search the inner Galaxy for these objects. Hillier (1985), Eenens *et al.* (1991), Blum *et al.* (1995a,b), Morris *et al.* (1996), and Figer *et al.* (1997) have characterized the near infrared spectra of emission-line stars studied at shorter wavelengths.

[1]Based on observations collected at *CTIO*, which is operated by AURA, under cooperative agreement with NSF

2. Observations

The narrow-band images, covering $l, b = (2 \text{ to } -1)°, (-0.5 \text{ to } +0.5)°$, have been obtained during three observing runs between 1996 June and 1998 July using the *CTIO* facility infrared imager CIRIM on the 1.5-m telescope ($f/8$).

The narrow-band line filters employed for this survey are 2.06μm (He I, hereafter the 206 filter, 0.5%), 2.08μm (C IV, 208, 0.5%), 2.17μm (Brγ, 217, 1%) and 2.189μm (He II, 219, 0.5%). The continuum filters are 2.03μm (203, 0.5%), 2.14μm (214, 0.5%), and 2.248μm (225, 1%). Two continuum filters are essential for each line since the large extinction ($A_V \simeq 30$ mag) results in continuum slopes which would dominate the line index if only one continuum filter were used. The seeing on individual frames is typically $\sim 2\farcs0$ (measured FWHM).

3. Analysis

We have adopted a photometry-based analysis, relying on matching photometry lists from the different images and then combining the resultant multi-wavelength data into line-indices. As a preliminary check on our search technique, we have searched the region around the Quintuplet cluster near the Galactic Center. The Quintuplet is a young cluster with a dozen or so WR stars and $A_V \simeq 30$ mag (Figer *et al.* 1999). Of the seven emission-line stars in our FOV listed by Figer *et al.* (1999: stars qF#235, qF#240, qF#241, qF#256, qF#274, qF#309, and qF#320), our automated routine found four at $I \gtrsim 2.5\,\sigma$. *I.e.*, the index was 2.5 times larger than the sum added in quadrature of the RMS deviation in the typical index plus the photometric uncertainty. The three objects which were not found (qF#235, qF#256 and qF#274) are all weak lined.

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