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ORIGINAL ARTICLE

2MASS and WISE data analysis of Galactic Wolf-Rayet stars

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Abstract We collected almost all Galactic Wolf-Rayet (hereafter WR) stars found so far from the literature. 578 WR stars are gathered in this paper. 2MASS counterparts with good quality magnitudes in all JHK bands are listed for 364 WR stars. In addition, WISE counterparts for these sources are also identified. It is found that free-free emission is the main dominant source for the infrared excess in most WR stars up to 3.4 µm. However at the longer wavelengths the thermal radiation is dominant. In addition, WR stars in Clusters of the Galactic center region have the strong infrared excess in the near infrared due to the dust thermal emission from the strong star forming activity in the Galactic center region. For some WR stars with the WC spectral type, in particular, with WCd type, the dust thermal emission is important radiation source while many WR stars with the WC spectral type have the near infrared flux enhancement from the broad line emission in the K band.

It is also shown that many single WC stars with different spectral sub-types have different locations in the near infrared two-color diagram, in particular, WC6 and WC9d stars can be separated respectively from other spectral type stars while single WN stars with different spectral sub-types can not be separated in the near infrared two-color diagram.

Keywords Star: Wolf-Rayet star · Infrared: star

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1 Introduction

It is generally accepted that Galactic Wolf-Rayet (hereafter WR) stars are evolved massive stars with initial masses greater than 20 $M_{\odot}$. They usually have strong and fast stellar winds with $M \sim 10^{-5}$ $M_{\odot}\,yr^{-1}$ displaying the heavier elements created by what are normally internal nuclear processes. They have distinctive spectra with strong and broad emission lines of helium, and either nitrogen (as classified as WN-type), or carbon (as classified as WC-type), as well as oxygen (as classified as WO-type) for their spectral classifications. As they have relatively short lifetimes about 5×10^5 yr, WR stars are excellent tracers of star formation, and they are also believed to be core-collapse supernova and γ-ray burst progenitors (van der Hucht 2006; Shara et al. 2009).

The field WR star can be found either as a single star or in binary system. However, some WR stars are population II stars in some clusters (van der Hucht 2001, 2006). Most WR stars are distributed in or close to massive star forming regions within the Galactic disk where the Galactic extinction is very large (Crowther 2007). Therefore observations in the infrared are very good way to find and study WR stars because of the smaller extinction in the infrared compared with that in the optical. In fact, since Allen et al. (1972), Allen and Porter (1973) firstly made the near infrared photometry for some WR stars, the photometric study of WR stars in the near infrared has got in progress. For example, Williams and Antonopoulou (1981) for 20 objects, Sterken and De Loore (1982) for 12 objects, Pitault et al. (1983) for 49 objects, Williams et al. (1987) for 41 objects, Homeier et al. (2003a) for some WR stars appeared in the VII WR star catalog (van der Hucht 2001) by using 2MASS data. Recently Crowther et al. (2006) made near infrared photometry for 24 WR starts in the Westerlund 1 cluster mainly