A Comparison between the Mira–OH/IR and the Carbon-Rich AGB Sequences

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Carbon-rich and oxygen-rich AGB stars are known to separate clearly into two parallel groups in color-color diagrams like K–L versus [12]–[25] (e.g. Epchtein et al. 1990, *A&AS*, 71, 39). We used this criterion to select a sample of 580 carbon-rich stars out of a larger sample observed in the $JHKLM$ bands with the 1-m ESO telescope. We investigate the energy distributions of these carbon-rich stars with the help of a simple model of a star represented by a blackbody, surrounded by a circumstellar dust shell. We show that the separation between carbon-rich and oxygen-rich stars in the color-color diagram can be explained by a difference in the condensation temperatures of dust grains, which implies different internal radius of the envelopes for the two flavors of AGB stars. A study of the oxygen-rich sequence from Miras to heavily obscured OH/IR stars (Lépine et al. 1995, *A&A*, 299, 453) showed that the main parameter which defines the position of a star along this sequence is the mass of the progenitor star. A single parameter like for instance the K–L color index determines almost completely other parameters like optical depth, mass-loss rate, luminosity, and the absolute magnitudes in each band. A similar study is now presented for carbon-rich AGB stars. The main parameters of carbon-rich stars, derived by fitting their infrared energy distribution with a model of a star plus a circumstellar envelope, are given as a function of the index K–L. Among other parameters, we obtain luminosities, effective temperatures and mass-loss rates. Our results allow more precise determination of the distances of carbon-rich AGB stars, which have usually been estimated assuming a constant luminosity.

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