

Molecular Bands in the 1.1–1.4  $\mu\text{m}$  Spectra of M–S–C stars

Kenneth H. Hinkle  
K.P.N.O., N.O.A.O.<sup>1</sup>

David L. Lambert  
University of Texas

Robert F. Wing  
Ohio State University

Spectra are presented in the J band (7400 to 9700  $\text{cm}^{-1}$ ) for four Miras ranging in spectral type from M through C. All the program stars have been observed near minimum light. The program stars cover a considerable range in C/O and the spectral features exhibit a progression as a function of C/O. The S-type stars contain strong bands not previously reported. Especially striking are two sets of triple-headed bands in the J-band spectrum of the S-type Mira R And. The bandheads, which are degraded to longer wavelengths, are at 7877, 7957, 8030  $\text{cm}^{-1}$  and 8379, 8459, 8530  $\text{cm}^{-1}$ . The former triplet, which is the stronger of the two, also is present in the mild S star  $\chi$  Cyg but not in the M star R Cas. Additional heads are found in R And at 7477  $\text{cm}^{-1}$ , near the short wavelength edge of strong telluric absorption, and at 8968, 9031, 9063  $\text{cm}^{-1}$ . The bands are identified as the  $\Delta v = -1, 0, 1,$  and  $2$  sequences of a predicted ( $^3\text{II}-^3\text{A}$ ) transition of ZrS. Additional conspicuous features in the spectra of  $\chi$  Cyg and R Cas are identified with VO, TiO, and H<sub>2</sub>O bands. These observations provide additional evidence that ZrS is responsible for the majority of the Keenan-Wing bands in the near infrared (0.7–1.1  $\mu\text{m}$ ). With additional laboratory work, the ZrS bands will provide an opportunity to measure sulfur abundances in late-type stellar photospheres.

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