

Molecular Bands in the 1.1–1.4 μm Spectra of M–S–C stars

Kenneth H. Hinkle
K.P.N.O., N.O.A.O.¹

David L. Lambert
University of Texas

Robert F. Wing
Ohio State University

Spectra are presented in the J band (7400 to 9700 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 cm^{-1} and 8379, 8459, 8530 cm^{-1} . The former triplet, which is the stronger of the two, also is present in the mild S star χ Cyg but not in the M star R Cas. Additional heads are found in R And at 7477 cm^{-1} , near the short wavelength edge of strong telluric absorption, and at 8968, 9031, 9063 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 χ Cyg and R Cas are identified with VO, TiO, and H₂O 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 μm). With additional laboratory work, the ZrS bands will provide an opportunity to measure sulfur abundances in late-type stellar photospheres.

¹Operated by the Association of Universities for Research in Astronomy, Inc. under contract with the National Science Foundation.