Inhomogeneities in molecular layers of Mira atmospheres

M. Wittkowski, D. A. Boboltz, M. Ireland, I. Karovicova, K. Ohnaka, M. Scholz, F. van Wyk, P. Whitelock, P. R. Wood, A. A. Zijlstra

(Submitted on 5 Jul 2011)

We obtained K-band spectro-interferometric observations of the Miras R Cnc, X Hya, W Vel, and RW Vel with a spectral resolution of 1500 using the VLTI/AMBER instrument. We obtained concurrent JHKL photometry using the the Mk II instrument at the SAAO. Our sources have wavelength-dependent visibility values that are consistent with earlier low-resolution AMBER observations of S Ori and with the predictions of dynamic model atmosphere series based on self-excited pulsation models. The wavelength-dependent UD diameters show a minimum near the near-continuum bandpass at 2.25 um. They increase by up to 30% toward the H2O band at 2.0 um and by up to 70% at the CO bandheads. The dynamic model atmosphere series show a consistent wavelength-dependence, and their parameters such as the visual phase, effective temperature, and distances are consistent with independent estimates. The closure phases have significantly wavelength-dependent non-zero values indicating deviations from point symmetry. For example, the R Cnc closure phase is 110 degr in the 2.0 um H2O band, corresponding for instance to an additional unresolved spot contributing 3% of the total flux at a separation of ~4 mas. Our observations are consistent with the predictions of the latest dynamic model atmosphere series based on self-excited pulsation models. The wavelength-dependent radius variations are interpreted as the effect of molecular layers. The wavelength-dependent closure phase values are indicative of deviations from point symmetry at all wavelengths, thus a complex non-spherical stratification of the extended atmosphere. In particular, the significant deviation from point symmetry in the H2O band is interpreted as a signature on large scales of inhomogeneities or clumps in the water vapor layer. The observed inhomogeneities might be caused by pulsation- and shock-induced chaotic motion in the extended atmosphere.

Comments:	5 pages, 2 figures, accepted for publication as a Letter in Astronomy and Astrophysics
Subjects:	**Solar and Stellar Astrophysics (astro-ph.SR)**
Journal reference:	A&A, 532, L7 (2011)
DOI:	10.1051/0004-6361/201117411
Cite as:	**arXiv:1107.0842 [astro-ph.SR]**

Submission history

From: Markus Wittkowski [view email]
[v1] Tue, 5 Jul 2011 10:44:23 GMT (141kb)