First Ever Polarimetric Detection of a Wind-Wind Interaction Region and a Misaligned Flattening of the Wind in the Wolf-Rayet Binary CQ Cep

A. Villar-Sbaffi(1), N. St-Louis(1), Anthony F. J. Moffat(1) and Vilppu Piirola(2,3)

1 - Département de Physique, Université de Montréal, C.P. 6128, Succursale Centre-Ville, Montréal, QC H3C 3J7, Canada; and Observatoire du Mont Mégantic.
2 - Tuorla Observatory, University of Turku, FIN-21500, Piikkio, Finland.
3 - Specola Vaticana, V-00120 Citta del Vaticano.

In this paper, we present unfiltered and multi-band (i.e. UBVRI) polarimetric observations of the short-period Wolf-Rayet binary CQ Cep. Using the basic assumptions of an optically-thin corotating envelope and point-like sources (i.e. BME78 assumptions), we determined the orbital parameters of the system [i.e. $i=(99\pm1)^o$ and $\Omega=(76\pm2)^o$ at the 2σ level] with an accuracy many times better than any previous work. Residual non-BME78 variability around phase 0.0 was present in our data, which we associate with the polarimetric eclipse of the dense central parts of the WR wind by the orbiting O-star. We attribute the observed phase-lag of -0.15 between our residuals and those expected for a standard polarimetric eclipse to a wind-wind interaction (WWI) region distorted by Coriolis forces based on the model presented by Marchenko et al. (1995). This model was also able to explain the strong wavelength-dependence of the polarimetric amplitudes in our multi-band observations. Our analysis also reveals important epoch-dependent departures of the matter distribution from spherical symmetry, which were not related to the orbital plane and therefore cannot be the result of tidal interaction. We conclude that binarity is not playing an important role in driving the wind of the WR star in CQ Cep and contributing to the observed non-spherical matter distribution. On the other hand, this asymmetry could be explained by a rotationally-induced disk misaligned with the orbital plane.

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Email: alfredo@astro.umontreal.ca