

Accretion-Wind interaction in the IC 10 X-1 Black Hole+Wolf-Rayet HMXB

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IC 10 X-1 is a high mass X-ray binary (HMXB) that consists of a black hole (BH) and a Wolf-Rayet (WR) star with an orbital period of 34.9 hours. In a series of Chandra and XMM-Newton observations, eclipses were discovered with duration of ≈ 5 hours. The source shows consistent variability around an X-ray luminosity of 7×10^{37} erg s⁻¹, in which the optical radial-velocity (RV) measurements from the He II line showed a phase shift compared to the X-ray ephemeris of the eclipse. This observation put in question the mass determination of the BH—either the He II line originates in a shadowed region of the stellar wind (hence it does not trace directly the motion of the WR star), or the BH is eclipsed by a trailing shock or plume. A shock front must be forming where the WR wind collides with wind emanating from the BH and its accretion disk. To understand the influence of X-rays on the WR optical spectrum, we used CMFGEN (Hillier 2011) to model a spectrum with X-rays embedded in the WR wind. CMFGEN takes into account non-LTE atmospheres and solves for the radiation field in comoving coordinates, but it uses a spherical geometry which does not account for asymmetries. We are using archival optical spectra in order to generate RV plots from other lines originating deeper inside the WR photosphere and compare them to those obtained from the current model. We hope that this investigation will lead to a more accurate determination of the BH mass in this HMXB.