RevMexAA (Serie de Conferencias), **33**, 136–136 (2008)

THE STRUCTURE OF THE WINDS OF ETA CARINAE AS SEEN BY *HST*/STIS AND *VLTI*/AMBER

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Eta Carinae (η Car) is currently understood to be a massive binary, within an extended wind, engulfed by its ejecta.

We examined the changes in stellar wind line profiles for multiple lines sampling a range of ionization potentials: He I (24.6−54.4 eV), H I (13.6 eV) and Fe II (7.9−16.2 eV). Changes in emission and absorption line profiles are apparent during the two observed spectroscopic minima (1998.0, ϕ=0 and 2003.5, ϕ=1.0). In Figure 1 we show the time variability of the line profiles and absorption velocity shifts across the observational interval for He I λ7065. This variability is caused by the interaction with the companion star (η Car B). The blue-shifted He I profile places η Car B at apastron on the observer's side of the primary. The hotter, faster and less massive η Car B wind is blowing a cavity out of the primary wind. The companion's UV radiation ionizes an adjacent portion of the primary wind to He^+ which shifts in shape and position as η Car sweeps around its orbit.

We created a simple model of the He^+ zone to understand the source of the He I emission and absorption. Models of η Car show that little He I emission is due to the primary star exciting its own stellar wind (Hillier et al. 2006). The He I lines represent the highly excited regions of the bow-shock and the adjacent portion of the primary wind. The blue-shifted, narrow emission line components originate from the cooling region beyond the wind-wind interface extending into the primary wind to the boundary of the hard UV radiation of the hot companion. Absorption originates from the He^+ region of the primary wind in line-of-sight from the primary star to the observer. For a more comprehensive description of the analysis, see Nielsen et al. (2007).

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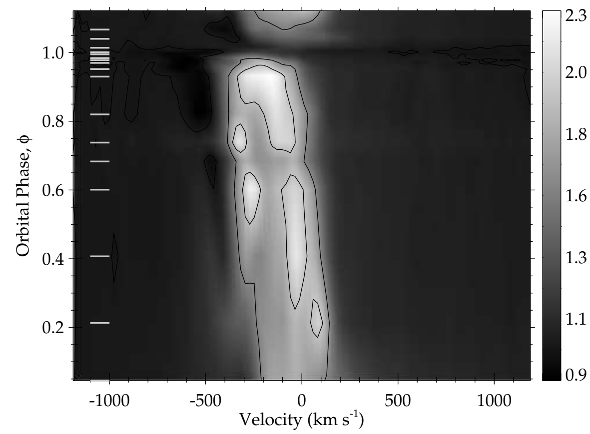

Fig. 1. Temporal surface plot of He I λ7067 from 1998.0 (ϕ=0.0) to 2004.3 (ϕ=1.2).

The spectrally dispersed interferograms from *VLTI*/AMBER allow investigations of the wavelength dependence of the visibility, differential phase, and closure phase. The AMBER measurements are in good agreement with predictions of the radiative transfer model of Hillier et al. (2001). If Hillier et al. (2001) model visibilities are fitted to the observed AMBER visibilities, we obtain 50% encircled-energy diameters of 4.3, 6.5 and 9.6 mas in the 2.17 μm continuum, the He I, and the H I Brγ emission lines, respectively. In the K-band continuum, we found an elongation toward position angle 120±15° with a projected axis ratio of 1.18±0.10. These observations support the theoretical model of an anisotropic wind from a dominating fast-rotating, luminous primary hot star with enhanced high-velocity mass loss near the polar regions.

We developed a physically motivated model which shows that the asymmetries measured within the line wings are consistent with the geometry expected for an aspherical, latitude-dependent stellar wind (Weigelt et al. 2006).

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