A companion as the cause of latitude-dependent effects in the wind of Eta Carinae

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We analyze spatially resolved spectroscopic observations of the Eta Carinae binary system obtained with HST/STIS. Eta Car is enshrouded by the dusty Homunculus nebula, which scatters light emitted by the central binary and provides a unique opportunity to study a massive binary system from different vantage points. We investigate the latitudinal and azimuthal dependence of H$alpha$ line profiles caused by the presence of a wind-wind collision (WWC) cavity created by the companion star. Using two-dimensional radiative transfer models, we find that the wind cavity can qualitatively explain the observed line profiles around apastron. Regions of the Homunculus which scatter light that propagated through the WWC cavity show weaker or no H alpha absorption. Regions scattering light that propagated through a significant portion of the primary wind show stronger P Cygni absorption. Our models overestimate the H alpha absorption formed in the primary wind, which we attribute to photoionization by the companion, not presently included in the models. We can qualitatively explain the latitudinal changes that occur during periastron, shedding light on the nature of Eta Car's spectroscopic events. Our models support the idea that during the brief period of time around periastron when the primary wind flows unimpeded toward the observer, H alpha absorption occurs in directions toward the central object and Homunculus SE pole, but not toward equatorial regions close to the Weigelt blobs. We suggest that observed latitudinal and azimuthal variations are dominated by the companion star via the WWC cavity, rather than by rapid rotation of the primary star.

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