

The emerging class of gamma-ray emitting colliding-wind binary systems

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Despite anticipation since the COS-B era, gamma-ray detections of particle-accelerating colliding-wind binary (CWB) systems are still not at all numerous even after a decade of Fermi-LAT observations. With η Carinae unambiguously established, the report of a weak detection of $\gamma 2$ Velorum (WR 11) as well as the low upper limits obtained for WR 140 and other CWBs contrast previous class assessments remarkably. In order to investigate the structure and conditions of the wind-collision region in these three systems we use three-dimensional magneto-hydrodynamic modeling, including the important effect of radiative braking in the stellar winds. A transport equation is then solved throughout the computational domain to study the propagation of relativistic electrons and protons. The resulting particle distributions are subsequently used to compute nonthermal photon emission components. We obtained results that can account for the weak detection of $\gamma 2$ Velorum, the strong detection of η Carinae, and the non-detection of WR 140 in identical computational setups, and expanded our modeling for WR 147 and HD 93129A.

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