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3D MHD simulations of particle acceleration in Gamma Velorum, Eta Carinae, WR 147, and HD 93129A

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In the light of new data regarding the high-energy γ-ray emission of suspected massive star colliding-wind binary systems, magneto-hydrodynamic simulations can now be refined and adapted in order to provide explanation of past and prediction of future emission characteristics of these sources.

We use three-dimensional magneto-hydrodynamic modeling to investigate the structure and conditions of the wind-collision region (WCR) of colliding-wind binary systems 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 with energies up to the GeV and TeV range. The resulting distributions of particles are subsequently used to compute nonthermal photon emission components.

Relying on a choice of physical parameters (as diffusion coefficient normalization and particle injection rate) that has been inspired by the recent modeling of γ^2Velorum (WR 11), we make use of known stellar and stellar wind parameters to simulate the non-thermal photon emission of the systems of η Carinae, WR 147, and HD 93129A. From the simulated spectra, we make predictions on their future detectability or - if already detected - about their variability pattern in high-energy γ-rays.

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