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Revealing the particle acceleration in stellar wind shocks of massive colliding wind binaries

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Binary systems comprising massive stars in relatively close orbits allow the presence of strong interaction between the two winds of the components. When the distance is close enough, an energetic shock is produced due to the collision of the two stellar winds, which can shine from radio wavelengths to very high energy gamma-rays.
These regions have proven to be extremely efficient environments to accelerate particles up to relativistic energies, involving higher mass, photon, and magnetic energy densities than their analogue processes in supernova remnants or interstellar bow-shocks. However, only a few of these systems are know to exhibit an exceptionally powerful and extreme region that could lead to emission in the high energy, and even in the very high energy range. Until recently, only Eta Carinae was the only colliding wind binary with such potential emission.

Thanks to very-high-resolution radio observations it is possible to trace in detail the wind collision region, characterizing the energy budget, magnetic field, and stellar wind properties of the two stars. Given that it is the same particle population producing the radio and the high-energy non-thermal emission, these studies allow tighter predictions on the high energy range.
In this talk I will discuss the discovery of two colliding wind binaries, HD 93129A and Apep, that have been predicted to produce emission at gamma rays, detectable by either Fermi or even CTA in the future. These sources would double the current detection of high-energy colliding wind binaries known up to now.

These studies require efforts covering the full electromagnetic spectrum, and combining both observational and theoretical point of views. To improve the relations between the different groups we have recently established the PANTERA-Stars (Particle Acceleration and Non-Thermal Emission of Radiation in Astrophysics - Stars) collaboration.

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