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Investigating the puzzling radio structures of the gamma-ray binary LS 5039

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LS 5039 is a gamma-ray binary system hosting a compact object and a massive O-type stellar companion. It presents a broadband emission spectrum that goes from radio up to gamma rays with energies of a few dozen TeV. There are two main physical scenarios proposed to explain this emission, both of them involving charged particle acceleration up to ultra-relativistic energies and their subsequent non-thermal radiative cooling as they propagate through a relativistic outflow. In the microquasar scenario, most of the non-thermal emission is originated in jets launched from the compact object. In the pulsar-wind scenario, in which the compact object is always a non-accreting pulsar, the non-thermal radiation comes from an outflow produced by the interaction of the pulsar and stellar winds.

In this contribution, we will present a semi-analytical model that computes the dynamical evolution of the outflows of LS 5039 in both scenarios. Using this hydrodynamical information, the model also includes a consistent computation of the radiation expected from this system. In particular, with the aim of discriminating between the two scenarios, we compute the extended radio emission of LS 5039 in both the microquasar and pulsar-wind cases, and compare it with the available observational data.

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