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High energy multi-messenger signals from symbiotic novae

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The detection of near-TeV gamma rays from the nova RS Ophiuchi (RS Oph) has confirmed that symbiotic novae (binary system of white dwarf and red giant stars) can act as TeV scale particle accelerators. However, the origin of these gamma rays, whether hadronic or leptonic—remains uncertain due to the non-detection a corresponding high energy neutrino signal. In the hadronic scenario, gamma rays and neutrinos are produced when high-energy protons accelerated in the nova shock interact with the ambient material. In this study, we analyse the detection possibility of the hadronic origin using current high-energy gamma-ray observatories (LHAASO, Fermi-LAT) and neutrino telescopes (IceCube, KM3NeT). We also examine an alternative mechanism in which protons from the nova wind are accelerated to high energies via magnetic reconnection occurring near the white dwarf's surface. In this scenario, high-energy gamma rays are expected to be fully absorbed by the dense environment, while neutrinos can escape unimpeded. We assess the detectability of these neutrinos and demonstrate that their spectral features differ significantly from those produced by shock-accelerated protons, making them distinguishable in detectors like IceCube and KM3NeT.

Collaboration you are representing

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