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Black-hole X-ray binaries in the new era of multi-messenger astronomy

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Since their discovery, cosmic rays (CRs) remain among the most mysterious phenomena of modern physics. The dominant sources, as well as the exact acceleration mechanisms, remain unknown. The CRs up to the knee, are considered to originate in the shock waves of supernova remnants, however, due to the lack of a "smoking-gun"TeV counterpart in many cases, this scenario has been recently questioned. In this talk, I will motivate how the small-scale analogues of active galactic nuclei (AGN), namely black-hole X-ray binaries (BHXBs), can potentially contribute to the Galactic CR spectrum. To investigate this idea, I developed a new, multi-zone, lepto-hadronic jet model to take advantage of the entire broadband multiwavelength spectra observed by BHXBs. I applied this model to the first-ever simultaneous radio-to-X-ray spectrum of Galactic BHXB Cygnus X-1 obtained in 2016 (via the CHOCBOX program), and to a quasi-simultaneous dataset of another Galactic BHXB, GX339-4, during a bright outburst in 2010. In this talk, I will discuss how the different assumptions on proton acceleration affect both the jet properties and the observed spectrum. In particular, I will focus on the GeV-to-TeV regime and discuss its strong dependence on the rest of the multiwavelength spectrum. Finally, I will discuss the implication of my results for the next-generation gamma-ray facilities, such as the Cherenkov Telescope Array (CTA), as well as next-generation neutrino detectors, such as KM3NeT, concluding how they can help to constrain the potential BHXB contribution to the Galactic CR spectrum.

Keywords

XRBs; gamma-rays; Galactic sources; black holes;

Collaboration

other Collaboration

Subcategory

Theoretical Results

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