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A leptonic view on the UHE Gamma-ray emission from V4641 Sgr

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Microquasars are binary systems which are composed of compact objects and stars, launching (sub-)relativistic jets. Recently, the microquasar V4641 Sgr is detected with extended ultra-high-energy(UHE) emission by LHAASO and HAWC. Interestingly, its spectrum follows a power-law function continuing up to 0.8 PeV, and the morphology appears a puzzling elongated structure which is misaligned with its radio jet at small scale. In this work, we propose that the elongated UHE emission from V4641 Sgr could originate from the inverse Compton radiation of electrons with a very hard spectrum, which may result from shear acceleration mechanism in the quasi-steady jet driven by V4641 Sgr. Under this model, the magnetic field within the jet is constrained to a μG level, although it depends on the transverse radius of the jet. We also calculate the corresponding X-ray synchrotron emission from the same electron population, predicting the potential range of non-thermal X-ray flux of the source. The recent observation by XRISM toward the central part of the UHE source may pose a constraint on the model parameters. In the future, a full coverage of the source by sensitive X-ray instrument may provide a critical test of the model.

Collaboration you are representing

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