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Low-luminosity jetted AGN as particle multi-messenger sources

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The detection of cosmic gamma rays, high-energy neutrinos and cosmic rays (CRs) signal the existence of environments in the Universe that allow particle acceleration to extremely high energies. These observable signatures from putative CR sources are the result of in-source acceleration of particles, their energy and time-dependent transport including interactions in an evolving environment and their escape from source, in addition to source-to-Earth propagation.
Low-luminosity AGN jets constitute the most abundant persistent jet source population in the local Universe. The dominant subset of these, Fanaroff-Riley 0 (FR0) galaxies, have recently been proposed as sources contributing to the ultra-high-energy cosmic ray (UHECR) flux observed on Earth. This presentation assesses the survival, workings and multi-messenger signatures of UHECRs in low-luminosity jet environments, with focus on FR0 galaxies. For this purpose we use our recently developed, fully time-dependent CR particle and photon propagation framework which takes into account all relevant secondary production and energy loss processes, allows for an evolving source environment and efficient treatment of transport non-linearities due to the produced particles/photons being fed back into the simulation chain.
Finally, we propagate UHE cosmic-ray nuclei and secondary cosmogenic photons and neutrinos from FR0 galaxies to Earth for several extragalactic magnetic field scenarios using the CRPropa3 framework, and confront the resulting energy spectra and composition on Earth with the current observational situation.

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