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Photon and neutrino emission from AGN jets with the same baryon loading

Blazars are the most energetic subclass of active galactic nuclei (AGN) with relativistic jets pointing towards the observer. It is believed that jets are launched as cold non-relativistic Poynting-flux dominated outflows which accelerate to relativistic speeds at the expense of the available magnetic energy. Part of this energy is also thought to be converted into energy of non-thermal particles. In this work, we consider electron-proton jets and assume that particles are energized via magnetic reconnection in parts of the jet where the plasma magnetization is still high, namely $\sigma \geq 1$. Particle-in-cell simulations of reconnection have shown that the power-law slope of the particle energy distributions depends on σ, while the amount of energy transferred into relativistic protons and electrons is roughly constant. Neutrino production is also expected to occur via photohadronic interactions between relativistic protons and photons. In our calculations, we worked under the assumption that all jets are launched with the same total energy flux per unit rest-mass energy flux, μ. This relates to the plasma magnetization and bulk Lorentz factor as $\mu = (\sigma + 1)\Gamma$. We adopt an observationally motivated relation between Γ and the mass accretion rate $\dot{m}$, which also controls the luminosity of external radiation fields. We compute self-consistently the multi-messenger emission from blazar jets as a function of μ, σ, and $\dot{m}$, and present our results for BL Lac objects and flat spectrum radio quasars.

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