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# The Impact of Plasma Instabilities on the Spectra of TeV Blazars

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Relativistic jets from blazars are known to be sources of very-high-energy gamma rays (VHEGRs). During their propagation in the intergalactic space, VHEGRs interact with pervasive cosmological photon fields such as the extragalactic background light (EBL) and the cosmic microwave background (CMB), producing electron-positron pairs. These pairs can upscatter CMB/EBL photons to high energies via inverse Compton scattering, thereby continuing the cascade process. This is often used to set limits on intergalactic magnetic fields (IGMFs). However, the picture may change if plasma instabilities, arising due to the interaction of the pairs with the intergalactic medium (IGM), cool down the electrons/positrons faster than inverse Compton scattering. As a consequence, the kinetic energy lost by the pairs to the IGM could cause a hardening in the observed gamma-ray spectrum at energies below ~100 GeV.

Here, we study several types and models of instabilities and assess their impact for interpreting observations of distant blazars by using an extension for CRPropa which takes into account these energy losses. Our results suggest that plasma instabilities can describe the spectra of some blazars and mimic the effects of IGMFs, depending on parameters such as the intrinsic spectrum of the object, the density and temperature of the IGM, and the luminosity of the beam. On the other hand, we find that for our fiducial set of parameters plasma instabilities do not have a major impact on the spectra of some of the blazars studied. Therefore, they may be used for constraining IGMFs.

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