Suppression of the TeV pair-beam plasma instability by a weak intergalactic magnetic field

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Several gamma-ray observations from distant blazars show a suppressed emission of the inverse Compton scattering cascade of the blazar-induced pair beams at the GeV energy band. There are two possible explanations, the first one is the deflections of the pair beam electrons and positrons by magnetic fields in the intergalactic medium. The second one is the drain of the pair energy by beam-plasma instabilities resulting in heating up the intergalactic plasma. The studies of plasma instabilities of blazar-induced pair beams in the literature neglect the effect of weak intergalactic magnetic fields.

In this work, we investigate the effect of weak intergalactic magnetic fields with small correlation lengths on the electrostatic beam-plasma instability:

- The weak intergalactic fields **increase** the angular distribution of the particles of the pair beam.

- The widening of the angular distribution **reduces** the linear growth rate of the electrostatic instability.

- This reduction of the linear growth rate **increases** the energy loss time of the beam-plasma instability.

- When the energy loss time of beam-plasma instability reaches the energy loss time of the inverse Compton scattering the plasma instability is **suppressed** (the plasma instability can no-longer suppress the GeV secondary emission).

- This suppression occurs at magnetic field strengths **three orders of magnitude** less than the lower limit of the magnetic fields needed to deflect the secondary cascade emission.