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Particle acceleration by magnetic reconnection and the production of gamma-rays in AGN relativistic jets and accretion disks

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3D Magnetohydrodynamic (MHD) resistive simulations have highlighted the unequivocal significance of widespread turbulence to drive fast reconnection. Moreover, it has been demonstrated that particle acceleration via reconnection in 3D magnetized flows, where turbulence is embedded within large-scale magnetic fields such as in relativistic jets and accretion flows around compact sources, is remarkably efficient. Particles experience Fermi acceleration across all scales of turbulent reconnection layers, outweighing the considerably slower drift acceleration mechanism. This stands in contrast to recent assertions stemming from Particle-in-Cell (PIC) simulations, that claimed the dominance of the latter process. In this talk, I will review how particle acceleration to very high energies is driven by 3D turbulent reconnection and highlight its potential in magnetized regions of AGN accretion disks and jets to explain the associated gamma-ray and neutrino emissions. Applications to sources such as TXS 0506+056, Mrk 501, and NGC 1068 will be discussed.

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