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High-energy neutrino and gamma-ray emission from AGN-driven winds

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Various observations are revealing the widespread occurrence of fast and powerful winds in active galactic nuclei (AGN) that are distinct from relativistic jets, likely launched from accretion disks. On sufficiently large scales, they are expected to interact with the gas of their host galaxies, leading to strong shocks that can accelerate nonthermal particles to high energies. Such winds have been suggested to be responsible for a large fraction of the observed extragalactic gamma-ray background (EGB) and the diffuse neutrino background, via the decay of neutral and charged pions produced in pp interactions between protons accelerated by the forward shock and the ambient gas. Taking into account processes such as adiabatic losses that were not properly included in earlier studies, we evaluate the production of gamma rays and neutrinos by AGN-driven winds in detail by modeling their hydrodynamic and thermal evolution. We find that they can only account for less than ~30% of the EGB flux, as otherwise the model would violate the independent upper limit derived from the diffuse isotropic gamma-ray background. We also identify ranges of parameters such as the spectral index for which AGN winds may still make an important contribution to the diffuse neutrino flux. Furthermore, we discuss the possibility of neutrino production via p-gamma interactions in the inner regions of the wind near the nucleus.

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