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High-energy Particle Emission and Cumulative Background from Low-Luminosity Active Galactic Nuclei

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The origin of high-energy neutrinos detected by the IceCube neutrino telescope is a big mystery of high-energy astrophysics. We propose low-luminosity active galactic nuclei (LLAGNs) as a novel source of the high-energy neutrinos. The radiation inefficient accretion flows (RIAFs) are believed to exist in LLAGNs. The Coulomb collisions inside RIAFs is so inefficient that plasmas naturally have high-energy protons through the stochastic particle acceleration. We calculate spectra of escaping neutrinos and cosmic-ray (CR) protons, and find that the RIAFs in LLAGNs can accelerate protons up to ˜ PeVs and emit TeV–PeV neutrinos via pp and/or pγ reactions. If ˜ 1% of the accretion luminosity is carried away by non-thermal protons, the diffuse neutrino intensity from the RIAFs in LLAGN can be compatible with the observed IceCube data (Kimura, Murase & Toma 2015, ApJ, 806, 159). This result does not contradict either of the diffuse gamma-ray background observed by Fermi or observed diffuse CR flux. This model can be tested by gamma-ray observations around the cores of LLAGNs (e.g., Fujita, Kimura, Murase 2015, PRD, 92, 023001).

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