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Diffuse axion-like particle searches

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We propose a new method to search for axion-like particles (ALPs) based on the gamma-rays produced concomitant with high-energy astrophysical neutrinos. The existence of high-energy neutrinos implies production of gamma-rays in the same sources. Photons can convert into ALPs in the sources' magnetic fields, and will travel as ALPs through extragalactic space. Back-conversion in the Milky Way's magnetic field leads to a diffuse anisotropic high-energy photon flux that existing and upcoming gamma-ray detectors, like HAWC, CTA, and LHAASO can detect. This method probes unexplored ALP parameter space, with LHAASO being realistically sensitive to couplings above 10^{−11} GeV^{−1} and masses up to 3×10^{−6} eV in ten years. Our technique also explores viable ALP dark matter parameter space.

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