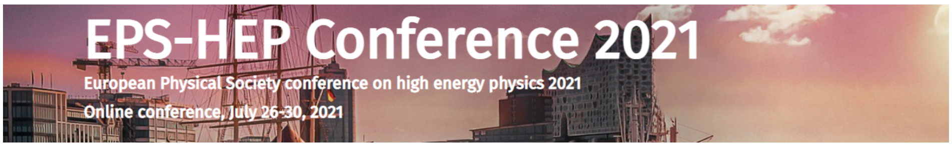

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Constraining the diffuse supernova axion-like-particle background with high-latitude Fermi-LAT data

Axions and axion-like particles (ALPs) are thought to be produced along with baryonic matter in a variety of astrophysical processes. Core-collapse supernovae (SNe) have been identified as a promising target to probe the existence of these hypothetical particles, which could make up at least a fraction of the universe's dark matter content.

The cumulative signal from all past SNe events would contain an ALP component and create a diffuse flux with energies $\mathcal{O}(50)$ MeV. Due to their coupling to photons and the related Primakoff process, the diffuse SNe ALP flux is converted into a diffuse gamma-ray flux while traversing the magnetic field of the Milky Way. The spatial morphology of this signal is expected to follow the shape of the Galactic magnetic field lines.

We perform a template-based analysis to constrain the ALP parameter space via the spatial structure of this ALP-induced diffuse gamma-ray flux using Fermi-LAT data from 12 years and an energy range from 50 MeV to 500 GeV. We find an improvement of the upper limit on the ALP-photon coupling constant $g_{a\gamma}$ of about an order of magnitude compared to a previous analysis solely based on the spectral shape of the signal. Our results are robust against variations in the modelling of high-latitude Galactic diffuse emission and systematic uncertainties of the LAT.

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Collaboration / Activity

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