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Bounds on diffuse supernova axion flux with $Fermi$-LAT

Friday 12 August 2022 10:00 (20 minutes)

Axion-like particles (ALPs) may be abundantly produced in core-collapse (CC) supernovae (SNe), hence the cumulative signal from all past SN events can create a diffuse flux peaked at energies of about 25~MeV.
We improve upon the modeling of the ALPs flux by including a set of CC SN models with different progenitor masses, as well as the effects of failed CC SNe – which yield the formation of black holes instead of explosions. Relying on the coupling strength of ALPs to photons and the related Primakoff process, the diffuse SN ALP flux is converted into gamma rays 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 make use of this via a template-based analysis that utilizes 12 years of Fermi-LAT data in the energy range from 50 MeV to 500 GeV. In our benchmark case of the realization of astrophysical and cosmological parameters, we find an upper limit of $g_{a\gamma}$
$lesssim 3.76 \times 10^{-11}~\mathrm{GeV}^{-1}$ at 95% confidence level for $m_a \ll 10^{-11}$ eV, while we find that systematic deviations from this benchmark scenario induce an uncertainty as large as about a factor of two.\\
Talk based on F. Calore $et~al$, "3D template-based $Fermi$-LAT constraints on the diffuse supernova axion-like particle background".

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