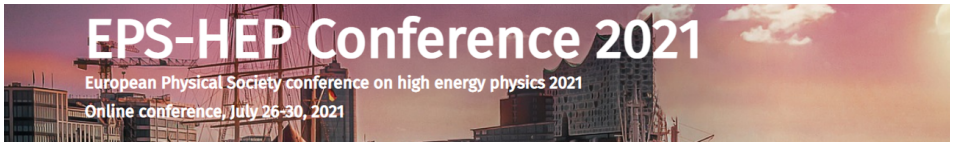

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Supernova bounds on axion-like particles coupled with nucleons and electrons

We investigate the potential of core-collapse supernovae (SNe) to constrain axion-like particles (ALPs) coupled to nucleons and electrons. ALPs coupled to nucleons can be efficiently produced in the SN core via nucleon-nucleon bremsstrahlung and, for a wide range of parameters, leave the SN producing a large ALP flux. For ALP masses exceeding 1 MeV, these ALPs would decay into electron-positron pairs, generating a positron flux. For Galactic SNe the annihilation of the created positrons with the galactic electron background would contribute to the 511 keV annihilation line. Using the observation of this line by the spectrometer SPI (SPectrometer on INTEGRAL), we obtain stringent constraints for the electron-ALP coupling, excluding the range $10^{-18} < g_{ae} < 10^{-11}$ for $g_{ap} < 10^{-9}$. Furthermore, ALP decays and subsequent electron-positron annihilations in the extra-galactic medium would yield a contribution to the cosmic X-ray background. Using this allows to set constraints down to the level $g_{ae} \sim 10^{-21}$.

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Collaboration / Activity

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