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ALPs: What can we learn from neutron stars and X-ray astronomy?

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Axion-like particles (ALPs) produced in the core of a neutron star can convert to photons in the magnetosphere, leading to possible signatures in the soft and hard X-ray emission from these sources. We study these signatures taking the magnetar SGR 1806-20 as an example. In particular, assuming ALP emission rates from the core that are just subdominant to neutrino emission, the parameter space of ALPs can be constrained by the requirement that the luminosity from ALP-to-photon conversion should not exceed the total observed luminosity from the magnetar. Up to astrophysical uncertainties pertaining to the core temperature, these constraints are competitive with constraints from helioscope experiments in the relevant part of ALP parameter space. Another class of signatures in this context are polarized X-rays, since ALPs only mix with the parallel component of the photon. These polarization signals may be observable by IXPE (in the 2-8 keV range) and X-Calibur (in the 15-60 keV range).

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