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Signatures of Axion Stars in the Milky Way

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Axion stars are coherent clumps of wavelike dark matter which are expected to form abundantly in dense structures like axion miniclusters. Due to their large central densities of up to $\rho_\star \sim 10^{23}\,\mathrm{GeV\,cm^{-3}}$ at a QCD axion mass of $m_a = 50\,\mu\mathrm{eV}$, it has been conjectured that they can give rise to a number of different observable signatures. Among these signatures are the resonant radio conversion of axion dark matter in the magnetic fields of neutron stars, parametric resonance in suitable soliton profiles and the generation of relativistic axions in collapsing axion stars, also called Bosenovae.
We calculate the galactic event rates for these signals and summarize the results of our recent paper on collision rates of axion stars in the Milky Way. Our analysis shows that the collision rates between miniclusters and neutron stars can become as large as $\sim 10^5\,\mathrm{yr^{-1}\,galaxy^{-1}}$, but that the fraction of encounters which can lead to resonance between axion mass and magnetosphere plasma frequency is generally well below $\sim 1\,\mathrm{yr^{-1}\,galaxy^{-1}}$. This suggests that Bosenovae and parametric resonance are much more likely to lead to observable signatures than neutron star encounters. We also discuss how axion star accretion can additionally enhance the expected event rates for both Bosenovae and radio bursts.

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