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Dilute and dense axion stars

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Axion stars are hypothetical objects formed of axions, obtained as localized and coherently oscillation solution to the classical equation of motion. I will discuss the family of axion star solutions for QCD axions. Depending on the value of the field amplitude at the core θ_0 , the equilibrium of the system arises from the balance of kinetic pressure and either self-gravity or axion self-interactions. I will show how the usual non-relativistic approximation breaks down for field values approaching $\mathcal{O}(\theta_0) = 1$. This *dense* regime can be described using a multi-harmonic expansion to solve the relativistic equation; we find that in this regime the life-time of the axion star is much shorter than any timescale relevant for cosmology.

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