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A self-consistent wave description of axion minicluster and their survival in the galaxy

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We present a solution of the Schrodinger–Poisson system based on the WKB ansatz for the wave function. In this way we obtain a description of a gravitationally bound clump of axion dark matter by a superposition of energy eigenstates with random phases. It can be applied to any self-consistent pair of radial density distribution and phase space density f (E) related by Eddington's formula. We adopt this as a model for axion miniclusters in our galaxy and use it to study the mass loss due to a star encounter by using standard perturbation theory methods known from quantum mechanics. Finally, we perform a Monte Carlo study to estimate the surviving fraction of axion miniclusters in the dark matter halo of our galaxy. We find that the reaction to perturbations and the survival probability depend crucially on the density profile. Weakly bound clusters are heated up and eventually destroyed, whereas more strongly bound systems get even more compact as a result of perturbations and are driven towards an axion star configuration.

Primary authors: DANDOY, virgile (Karlsruhe Institute of Technology); Dr TODARELLO, Elisa (Universita di Torino); Prof. SCHWETZ, Thomas (Karlsruhe Institute of Technology)

Presenter: DANDOY, virgile (Karlsruhe Institute of Technology)

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