

Resonant enhancement of axion dark matter decay

The axion is a particularly well-motivated candidate for the dark matter comprising most of the mass of our visible Universe, leading to worldwide experimental and observational efforts toward its discovery. As is well known, resonant cavities are a primary tool in this search, where they are used to enhance the conversion rate of axions into photons in a background electromagnetic field. What is perhaps less well appreciated is that resonant cavities can also enhance the rate at which axions decay to two photons, a manifestation of the Purcell effect. We examine this possibility and show that it offers a previously unexplored method to search the axion parameter space in a way that is competitive and complementary to other approaches, with the capability to probe a well-motivated region for QCD axion dark matter. Furthermore, we establish that this method can be implemented via preexisting axion heterodyne detection schemes, enabling such experiments to perform these searches with minimal modification.

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