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Single photon detectors for dark matter axion searches

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Dark matter is the name that we give to the 85% of matter in the universe that interacts via gravity but negligibly with any of the other known forces. One compelling model for dark matter is the axion, as it simultaneously solves the existence of dark matter and the strong CP problem in QCD. Axions may be detectable using haloscopes, which rely on axion-photon coupling in the presence of magnetic field. A major challenge of axion searches at higher frequencies is that the time required becomes increasingly long because of lower signal and increased quantum noise when using a standard haloscope. Building a more sensitive experiment requires eliminating quantum noise, which can be accomplished by detecting single photons. Rydberg atoms are sensitive single photon detectors, and therefore can be used to render the axion search at higher frequencies tractable. This poster presents the progress on the design of the Rydberg atoms for Axions at Yale (RAY) experiment, which aims to find QCD axions at and above 12 GHz.

In-person or Virtual?

In-person

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