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The search for axion-like dark matter using magnetic resonance[1]
ALEXANDER SUSHKOV, Boston Univ, CASPER COLLABORATION — The nature of dark matter is one of the most important open problems in modern physics, and it is necessary to develop techniques to search for a wide class of dark-matter candidates. Axions, originally introduced to resolve the strong CP problem in quantum chromodynamics (QCD), and axion-like particles (ALPs) are strongly motivated dark matter candidates. Nuclear spins interacting with axion-like background dark matter experience an energy shift, oscillating at the frequency equal to the axion Compton frequency. The Cosmic Axion Spin Precession Experiments (CASPEr) use precision magnetometry and nuclear magnetic resonance techniques to search for the effects of this interaction. The experimental signature is precession of the nuclear spins under the condition of magnetic resonance: when the bias magnetic field is tuned such that the nuclear spin sublevel splitting is equal to the axion Compton frequency. These experiments have the potential to detect axion-like dark matter in a wide mass range (10^{-12} eV to 10^{-6} eV, scanned by changing the bias magnetic field from approximately 1 gauss to 20 tesla) and with coupling strengths many orders of magnitude beyond the current astrophysical and laboratory limits, and all the way down to those corresponding to the QCD axion.

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