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CASPEr: The lab-scale NMR-based search for axion-like dark matter

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The nature of dark matter is one of the most important open problems in modern physics. 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 a torque, oscillating at the axion Compton frequency. The Cosmic Axion Spin Precession Experiments (CASPEr) use precision magnetometry and nuclear magnetic resonance (NMR) techniques to search for the effects of this interaction. CASPEr has 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 0.1 gauss to 10 tesla), and with coupling strengths orders of magnitude beyond the current astrophysical and laboratory limits, and all the way down to those corresponding to the QCD axion.