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Experimental Status of the Cosmic Axion Spin Precession Experiment (CASPEr-Wind)

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The Cosmic Axion Spin Precession Experiment (CASPEr), particularly the CASPEr-Wind, is a detection scheme searching for particles with a coupling to nuclear spin; some examples being dark matter candidates like the axion/axion-like particles, hidden photons, or any pseudo-Goldstone boson [1,2,3]. The coupling induces precession of the nuclear spin about the axion momentum which will be detected using nuclear magnetic resonance (NMR) techniques. In this talk, current experimental progress will be presented for the various components involved.

The sample for CASPEr-Wind is hyperpolarized liquid xenon, which preparation of is a critical part of the experiment. We will report on our spin-exchange optical pumping cell, unique in design, for the hyperpolarization of gaseous xenon including it's accompanying diagnostics. The hyperpolarized xenon is condensed in a spherical sapphire cell held at liquid temperature inside of a superconducting magnet within the 'variable temperature unit' probe (VTI). This VTI utilizes temperature controlled nitrogen gas and insulation to maintain the $\sim$170 K differential. We will discuss it's design and prototyping, including initial tests of our superconducting quantum interference devices (SQUIDs) used to detect the NMR signal induced by the dark matter.

[1] D. Budker et al., Phys. Rev. X 4, 021030 (2014).

[2] P. W. Graham and S. Rajendran, Phys. Rev. D 88, 035023 (2013).

[3] P. W. Graham et al., Annu. Rev. Nucl. Part. Sci. 65, 485–514 (2015).

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