

# Laboratory Search for New Spin-Dependent Interaction : Axion Resonant Interaction Detection Experiment (ARIADNE)

Thursday, 25 June 2015 17:20 (20 minutes)

Axions are light pseudoscalar particles originally proposed by Peccei and Quinn (PQ) to explain the strong CP problem in QCD [1]. Axions could be a possible component of cold dark matter if their mass is in very light regime. Direct search of axions dark matter is the object of current experiment at the Center for Axion and Precision Physics (CAPP), Institute for Basic Science (IBS). This experiment involves axion to photon conversion in a resonant cavity [2]. In addition, Axions and other axion-like particles (ALP) would mediate spin-dependent interactions in macroscopic scale [3]. A precision experiment that can detect axions by measuring spin-dependent interactions in very short range has been recently proposed from ARIADNE collaboration [4]. The experiment includes high sensitivity SQUID NMR with polarized  $^3\text{He}$  nuclei using the metastability-exchange optical pumping (MEOP) method and a radially slotted tungsten as unpolarized source mass to induce a resonant monopole-dipole interaction. With proper magnetic shielding, it will resonantly enhance the effective magnetic field signal from the spin-dependent interaction mediated by axion. The proposed experiment can look into axions in their mass range between  $10^{-5}$  eV to  $10^{-2}$  eV which is very complementary with our experimental search of axions with resonant cavity. We describe the experimental plan including  $^3\text{He}$  optical pumping system at CAPP, IBS.

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[2] P. Sikivie, Phys. Rev. Lett, 51,1415, (1983).

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[4] A. Arvanitaki and A. Geraci, Phys. Rev. Lett. 113, 161801 (2014).

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