

WISPLC: Search for Dark Matter with LC Circuit

Monday 8 August 2022 11:50 (20 minutes)

The focus on dark matter search has expanded to include low-mass particles such as axions or axion-like particles (ALPs), and novel theoretical schemes extending the phenomenological landscape, within QCD and beyond, also garnered additional interest in recent decades. Assuming dark matter is composed of axions, in presence of a strong magnetic field, they induce a displacement current that generates a magnetic field detectable by state-of-art superconducting quantum interference device (SQUID). The Weakly Interacting Slender Particle detection with LC circuit (WISPLC) is a precision direct detection experiment that will search for light dark matter candidates such as ALPs in parts of the parameter space previously unexplored. The key facility is a large-scale cryogen-free magnet system that can produce a maximum solenoidal magnetic field of 14 Tesla at the center of the bore, inducing an axion-sourced toroidal magnetic field which can be captured by a pickup loop. We present two detection scheme: a broadband detection with up to 2 MHz bandwidth, and a resonant scheme where a LC circuit is used to enhance the signal with an expected Q factor $\sim 10^4$. Taking into account the irreducible intrinsic flux noise of the detector, we estimate the sensitivity of the experiment in the axion mass range between 10^{-11} eV and 10^{-6} eV to reach a detectable axion-photon coupling of $g_{a\gamma\gamma} \approx 10^{-15} \text{ GeV}^{-1}$, making it possible to probe mass ranges corresponding to ultralight axions motivated by string theory.

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Session Classification: Contributed talks