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The ALPS II Experiment

The Any Light Particle Search (ALPS) II is a light-shining-through-a-wall (LSW) experiment which investigates the existence of axions and axion-like-particles (alps) in the sub-eV mass range. Their existence is motivated by QCD physics, astrophysics and cosmology; alps are also promising candidates for dark matter. ALPS~II aims to probe the coupling of axions and alps (to photons) down to a value of $g_{a\gamma\gamma} = 2 \cdot 10^{-11}$\,GeV^{-1}, which is a significant enhancement over the previously probed regions, independent of the dark matter paradigm. ALPS~II seeks to convert 1064\,nm photons into axions/alps in the presence of a magnetic field, in an optical cavity. After passing through a light-tight barrier, these particles can reconvert to photons in another optical cavity, and subsequently be detected. The use of resonant mode-matched optical cavities with photon and signal build-up in them substantially increases the probability for photons to convert to axions/alps and back. The expected signal amounts to about one low-energy (1.165\,eV) 1064\,nm photon per day, requiring a detector capable of observing this extremely low regenerated photon rate $\mathcal{O}(10^{-5})$\,cps with a correspondingly low dark rate and high detection efficiency. For ALPS II, this is realised by using two detection schemes: a heterodyne detection and a transition edge sensor (TES) scheme. Here, we describe the technical details of the ALPS II experiment, in preparation for a science run in 2022 and the current status TES detection system which will be implemented after the heterodyne scheme. Ongoing investigations, important results, and planned tests will also be discussed.

In-person participation

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