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A TES for ALPS II

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The Any Light Particle Search ALPS II is a light-shining-through-a-wall (LSW) experiment to investigate the existence of axions and axion-like-particles (ALPs) in the sub-meV mass range. The existence of these particles is motivated by multiple quarters, from QCD to stellar physics. ALPS II aims to convert 1064 nm photons into axions or ALPs aided by the presence of a magnetic field, in an optical cavity. After passing through a light-tight barrier, these particles reconvert to photons in another optical cavity in a magnetic field, before subsequent detection. The expected signal amounts to about one 1064 nm photon per day, necessitating a detector capable of observing this low regenerated photon rate $\mathcal{O}(10^{-5})$ cps with a correspondingly low background rate at this low energy, with high detection efficiency. These demands can be met by a transition edge sensor (TES), a cryogenic microcalorimeter, employing the drastic variation in its resistance at its superconducting transition temperature. The experimental details of this detection setup, its operation, and characterisation are described. With an energy resolution $\sim$10% and a viably low (intrinsic) background rate demonstrated, tests to optimise its efficiency, to diagnose, simulate and suppress backgrounds, and to probe its use for other physics goals are ongoing. These results and investigations will be discussed, as well as the planned implementation of the TES in ALPS II in 2023.

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