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Heterodyne detection in the ALPS II experiment

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The Any Light Particle Search (ALPS) II is an experiment designed to search for weakly interacting sub-eV particles that couple to photons in the presence of a magnetic field. In order to detect the extremely weak photon fields associated with the existence of such hypothetical particles, the detector employed needs to be sensitive to power levels equivalent to a few photons per week. The ALPS group at the University of Florida has developed a detection method based on heterodyne interferometry that takes advantage of the coherent nature of the expected signal field. We use optical techniques similar to those found in modern day gravitational wave experiments to precisely track the phase of the signal over measurement times of several weeks with a precision better than 0.1 cycles.
We will report on the design and tests of the heterodyne optical setup and its associated shot-noise-limited detector.

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