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ALPS-II cavity control with a surrogate field: model and experiment

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Any Light Particle Search (ALPS) is a series of laboratory light-shining-through-a-wall experiments seeking light-weight sub-eV dark matter candidates including the well-motivated axion-like-particles (ALPs). To extend the experiment sensitivity into scientifically interesting parameter space in terms of ALP-photon coupling, in addition to using long dipole magnets from HERA, ALPS-II anticipates aggressive resonant optical gain, for which a dichroic control concept has been developed to be in line with the transition edge sensor for photon counting. The dichroic control concept is based on two laser wavelengths with a quasi-harmonic frequency relation, and one of the main challenges is to ensure a constant frequency offset between these two laser fields that are in simultaneous resonance with the dichroic optical cavity in ALPS-II throughout science data-taking. We will elaborate on such dichroic control concept, derive specific requirements for ALPS-II based on realistic modelling, and present the results from our prototyping experiment.

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