

UPLOAD: UPconversion Low-Noise Oscillator Axion Detection Experiment

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UPLOAD is an axion detection experiment which is a variation upon the haloscope detector, using two resonant microwave modes within a cavity and removing the need of an external magnetic field. The effect of an external magnetic field is substituted by the overlap between the electric and magnetic field components of the two resonating modes themselves. As implied in the name, coupling between the photon modes and the axion field would be evidenced by upconversion of photons into the readout mode. As such, the targeted axion frequency is equal to the difference between the two resonating photon frequencies, dependent upon the chosen cavity geometry. The current experiment involves gigahertz electromagnetic modes, tunable via cavity height, separated by tens of megahertz, hence probing axions in the megahertz range. Two variations of the UPLOAD experiment have been constructed –one probing frequency noise induced on a readout mode, the frequency metrology method, and one probing power deposition in the readout mode, the power method. The frequency metrology method involves pumping both modes with synthesized signals and collecting Fourier spectra around the actively stabilized readout mode with a low noise frequency discriminator. The power method, in resemblance to a traditional haloscope, simply interrogates the thermal noise at the frequency of the readout mode for any axion-like interference peaks, while pumping power into the pump mode to boost SNR. This talk will cover experimental details and present axion exclusion limits derived from both experimental variations and discuss avenues for improvement and subsequent projected limits for future runs.

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