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Searching for Low-Mass Axions using Resonant Upconversion

We present new results of a room temperature resonant AC haloscope, which searches for axions via photon upconversion. Traditional haloscopes require a strong applied DC magnetic background field surrounding the haloscope cavity resonator, the resonant frequency of which is limited by available bore dimensions. UPLOAD, the UPconversion Low-Noise Oscillator Axion Detection experiment, replaces this DC magnet with a second microwave background resonance within the detector cavity, which upconverts energy from the axion field into the readout mode, accessing axions around the beat frequency of the modes. Furthermore, unlike the DC case, the experiment is sensitive to a newly proposed quantum electromagnetodynamical axion coupling term g_{aBB}. Two experimental approaches are outlined - one using frequency metrology, and the other using power detection of a thermal readout mode. The results of the power detection experiment are presented, which allows exclusion of axions of masses between $1.12 - 1.20\ \mu eV$ above a coupling strength of both $g_{a\gamma\gamma}$ and g_{aBB} at 3×10^{-6} 1/GeV, after a measurement period of 30 days, which is a three order of magnitude improvement over our previous result.

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