

C12-21-003: *A Direct-Detection Search for Hidden Sector New Particles in the 3-60 MeV Mass Range*

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This is a conditionally accepted proposal aiming to search for a “dark boson” using the PRad infrastructure at Jefferson Lab. The science justification proposal is unchanged from the original submission.

There is an ongoing program of efforts at JLab focusing on exploring such extensions of the Standard Model, and the aim of this proposal is to explore a missing region of the $m_A - \epsilon$ plane, where m_A and ϵ are mass of the particle, and ϵ the coupling to the Standard-Model Field, and in particular a region of sub-GeV mass that is motivated by astrophysical and experimental anomalies.

The proposal includes a comprehensive summary of the motivations for this experiment, including a discussion of the muon $g - 2$ results from FNAL. As noted, the FNAL result is consistent with the previous BNL results. An important question is whether these results are indeed consistent with a 4.2σ discrepancy with the Standard Model. That discrepancy is dependent on a precise quantitative understanding of the hadronic contributions. This is the subject of intensive activity within the lattice community, and a recent computation by the BMW group (Nature, 2021), argues that the discrepancy might be $\mathcal{O}(1.5\sigma)$. None of this does anything to lessen the importance of this proposed experiment, but it will be important to be “agile” as the experimental and theoretical situation evolves.