

A new dark photon search in the 3-60 MeV range using the PRad detector at JLab*

Tyler J. Hague

North Carolina A&T State University

In JLab PAC49, we proposed a now conditionally-approved experiment to search the 3-60 MeV mass region with the Bremsstrahlung-like production process using the PRad detector in Hall B at JLab. The 1-100 MeV mass range is a well-motivated region to search for a dark photon. Astronomical small-scale structure, the muon anomalous magnetic moment, and the so-called X17 anomaly all suggest that a search in this region is warranted. Our novel technique will suppress background by detecting all final state particles, the scattered beam electron and the decay products of the dark photon (either e^+e^- or $\gamma\gamma$). The setup will use a $1\mu\text{m}$ Tantalum target 7.5m upstream of the HyCal calorimeter. After the PRad target chamber, the particles will travel through a 5.0m vacuum box that then interfaces with two GEM planes, separated by 0.1m, to provide modest tracking for charged particles. The inclusion of the two GEM planes will allow for reduction of beamline backgrounds by ensuring that the detected physics originated in the target. The experiment will use two beam energies to suppress “false bumps” from non-physics processes. This experiment will have a 5σ sensitivity to the mass region with coupling constant, ϵ^2 , from 5.9×10^{-9} at lower masses to 7.2×10^{-8} at higher masses.

*My work is supported by NSF Grant NSF PHY-1812421