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Searches for a Lepto-phobic "Dark Omega"with the GlueX Detector

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The GlueX experiment has had several run periods with a 9 GeV photon beam, its ultimate goal being the search for exotic hybrid mesons. While we improve our understanding of the GlueX detector needed for a high precision PWA, it is possible to carry out a dark matter search now. Constraints on the allowed coupling versus mass of a dark lepto-phobic boson, a hypothetical state with JPC = 1^{--} called the dark omega or ω_D, are surprisingly weak.[1] For example, for 0.4-1.0 GeV/c2 , a coupling constant as large as α_{EM} ~ 1/137 has not yet been excluded. Light meson decays can yield greatly improved constraints in the mass range 0.15-0.5 GeV/c2 where the ω_D would decay predominantly to $\pi^0 + \gamma$. The irreducible SM backgrounds are rare decays of the initial mesons, so the principle experimental challenges are to produce a large number of appropriate mesons with good acceptance for photons, hence well-suited to GlueX. Direct production via $\gamma + p \rightarrow p + \omega_D$ is an exciting new proposal which covers an even broader mass range[2], and may be the best way to access the 0.5-1 GeV/c2 mass region where the ω_D would decay predominantly to $\pi^+\pi^-\pi^0$. The SM backgrounds are relatively large in the direct case, but they only dilute the sensitivity of the measurement by the inverse square root of the background. The status and potential sensitivity of dark omega searches with GlueX will be summarized.

[1] S. Tulin, https://arxiv.org/abs/1404.4370 ,

[2] C. Fanelli and M. Williams, https://arxiv.org/abs/1605.07161

Primary author: MACK, David (TJNAF)

Presenter: MACK, David (TJNAF)

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