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Amplitude-level Effects in Bhabha Scattering from Dark Boson Exchange

Monday, 8 July 2024 15:00 (20 minutes)

The Positron Working Group at Jefferson Lab is designing a positron source, transport beamlines, and experiments for an exciting physics program to begin in the mid-2030's. Some topics which will play important roles include Deeply Virtual Compton Scattering as a probe of GPDs, improving our understanding of the nucleon EM form factors, precision studies of 2-photon exchange, and searches for dark matter.

Previous searches for a dark photon have usually required its on-shell production, and published results have reached high sensitivity. However, a significant region of phase space remains unexcluded in the JLab energy regime which will require new experiments effectively having several orders of magnitude higher Figure of Merit. Searching for amplitude-level signals is the approach I discuss here. This also avoids the interpretational ambiguity arising in many experiments from the unknown details of a potential dark photon decay.

In Bhabha scattering, $e^+e^- \rightarrow e^+e^-$, the virtual exchange of a dark boson would interfere with photon exchange to produce changes in the yield and polarized-beam asymmetries. These effects would be relatively large in the s -channel near resonance. I will present exploratory calculations of several observables which appear most useful for amplitude-based dark photon searches in the mass range of approximately 10-100 MeV/c².

session

K. Precision and New Physics

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