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Probe axion-like particles at the electron-ion collider

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The electron-ion collider (EIC), a new powerful high-luminosity
facility, will be able to open up new windows of opportunities to explore new physics. In this paper, we study the potential of the EIC to probe the coupling between axion-like particles (ALPs) and photons in coherent scattering, where the ion stays intact, resulting in a cross section enhancement proportional to the square of the proton number. The ALPs can be produced via photon fusion and decay back to two photons inside the EIC detector. In the prompt-decay searches, we find the EIC can set the most stringent bound for ma ⊠ 10 GeV and can reach the effective coupling 1/Λ at 10−6 GeV−1 level. For the displaced decay, we are able to probe GeV ALPs with 1/Λ = 10−7 GeV−1.

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