

Light Dark Matter at the Forward Physics Facility

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Light sub-GeV dark matter particles interacting through a kinetically mixed dark photon may be copiously produced in the far-forward region at the LHC. These dark matter particles may then be detected through their scattering off electrons. We show that thousands of scattering events may be detected in the HL-LHC era by a 10-ton emulsion detector placed on the beam collision axis 500 m from the ATLAS interaction point in the proposed Forward Physics Facility. We consider the leading backgrounds from neutrino-electron scattering, neutrino quasi-elastic scattering, charged current deep inelastic scattering, and muon-induced photon pair production. With an upstream magnet to mitigate low-energy muons and optimized cuts on the electron energy and direction, we find that such an emulsion detector can probe the entire thermal relic region for masses $m_{A'}$ between 10 and 100 MeV.

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