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# Probing dark sectors with proton bremsstrahlung

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Experiments using proton beams at high luminosity colliders and fixed-target facilities provide impressive sensitivity to new light weakly coupled degrees of freedom. We revisit the production of dark vectors and scalars via proton bremsstrahlung for a range of beam energies, including those relevant for the proposed Forward Physics Facility (FPF) at the High Luminosity LHC, and upgraded beamlines at Fermilab. In addition, we extend the application of proton bremsstrahlung to other long-lived dark sectors such as axion-like particles (ALPs) with gluon coupling and millicharged particles. In another direction, we utilize the significant neutrino flux in the forward direction at the LHC to study the electromagnetic properties of neutrinos, which serve as a probe to new physics beyond the Standard Model. In particular, we set stringent constraints on the magnetic moment, millicharge, and charge radius of tau neutrinos.

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