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New physics opportunities for long-lived particles at electron-proton colliders

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Future electron-proton (ep) collider proposals like the LHeC or the FCC-eh can supply 1/ab of collisions with a center-of-mass energy in the TeV range, while maintaining a clean experimental environment more commonly associated with lepton colliders. This makes them ideally suited to probe BSM signatures with final states that look like “hadronic noise” in the high-energy, pile-up-rich environment of hadron colliders. Focusing on the generic vector boson fusion production mechanism, which is available for all BSM particles with electroweak charges, ep colliders can probe mass scales far above the reach of most lepton colliders. This unique experimental environment can be exploited in the search for long-lived particles (LLPs), which are theoretically very highly motivated and can feature in a broad class of BSM theories. In this talk, signals arising from long-lived Higgsinos and exotic Higgs decays will be presented as case studies. At ep colliders, LLPs with soft decay products and very short lifetimes can be probed, thus exploring significant regions of BSM parameter space inaccessible to other collider searches. This also provides important implications for the design of such machines.

This is based on the work presented in arXiv:1712.07135.

Summary

Long-lived particles

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