

Exploring the LHC as a TeV Muon Beam Dump: Muonphilic Scalars at FASER

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At FASER, neutrinos are predominantly produced from meson decays, which also result in an intense energetic flux of muons in the forward direction, which are regularly observed by FASER. So far, these muons are treated only as backgrounds to neutrino and new physics studies, and extensive effort is required to suppress them. Here, we consider the opposite scenario and use muons produced in the forward direction to produce new muonphilic scalars, which can then be searched for at the FASER detector. To minimize background for this search, we make use of an upgraded preshower component, which is expected to be installed at FASER before the end of Run 3, and is capable of spatially resolving two energetic photons. We find that FASER and FASER2 can probe currently unconstrained regions of parameter space, including regions that can potentially explain the $(g - 2)_\mu$ anomaly. This highlights the physics opportunities that the intense TeV muon beam at the LHC can bring.

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