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Looking Forward to Dark Photons at the LHC

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New physics has traditionally be sought in the high transverse momentum region at high-energy collider experiments. We show that, if the new physics is light and weakly-coupled, the very forward region also provides a promising location for new particle searches. Given an integrated luminosity of 300 fb^{-1}, 10^{16} light mesons are produced at ATLAS and CMS within 1 mrad of the beamline, and even extremely weakly-coupled light particles may be produced in significant numbers in these meson decays. As a concrete example, we consider dark photons with mass $m_{A'} \sim$ MeV-GeV and kinetic mixing parameter ϵ. Such dark photons may be produced in π^0 and η decays, pass through a couple houndred meters of matter without interacting, and then decay to and electron-positron pair. We propose a new detector, ForwArd Long-lived dArk PHoton Experiment at the Lhc (FALAPHEL), placed roughly 100 to 400 meters downstream from the ATLAS or CMS interaction point and just off the beamline in the very forward region. We find that dark photons can be discovered in a significant region of dark photon parameter space with $m_{A'} \sim$10-400 MeV and $\epsilon \sim 10^{-6} - 10^{-4}$.

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