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FCNC in Concurrent Dark Photon & Dark Z Models

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In this work we consider FCNC constraints on concurrent dark vector boson models simulatneously from B and K decays. Both the dark photon and the dark Z generate FCNC processes through loops due to kinetic mixing with the SM photon and Z boson respectively. Previously, the FCNC amplitudes with the dark photon and dark Z decays were calculated without the dipole term in the amplitude. Also, bounds on the gauge coupling and mixing parameter have only been obtained for either the dark photon case or the dark Z case. In our analysis, we perform a robust fit to the parameters of the most general dark vector model with light gauge bosons from the available data on meson decays. In the mass range of interest, the dark photon/Z can decay to neutrinos, charged leptons as well as light hadrons including several hadronic resonances which cannot be treated perturbatively. Very recently, the decay widths of such light vector bosons were calculated using the vector dominance model of chiral perturbation theory and fitting to the e+e− cross-sections from several experiments. We incorporate these results in our calculations to improve the analysis. We show constraints on the parameter space by considering both long distance and short distance NP.

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