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Dark Matter Induced Proton Decays

We present a novel framework for dark matter induced proton decay. This scenario arises naturally from a $U(1)_{B+L}$ symmetry, whose spontaneous breaking triggers the proton decay. This breaking leads to a residual Z_4 subgroup, which ensures dark matter stability and forbids proton decay at tree level. Consequently, proton decay occurs at the one-loop level, mediated by dark sector particles. The $\mathcal{O}$(TeV) masses of the mediators remain consistent with current proton lifetime limits, making them accessible in upcoming experiments. Notably, the proton lifetime limit constrains the dark matter mass range, resulting in a viable parameter space from 500 GeV to a few TeV. Furthermore, leptoquark mediating proton decay, carrying exotic $(B+L)$ charges, leads to a distinctive signature in collider searches. By intertwining proton decay, dark matter stability, and collider phenomenology, this framework not only sheds light on baryon number violation but also provides a promising avenue for future experimental probes.

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