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Dark Hypercharge Symmetry

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The gauged $U(1)_X$ extensions of the Standard Model are some of the most popular and extensively studied new physics models. In most of these models the charges of SM fermions are fixed by gauge anomaly cancellations. While the literature extensively discusses anomaly cancellation solutions in which SM fermions are "vector-like" under new symmetry, chiral solutions in which SM fermions are chiral under new symmetry are not well explored. In this work, we explore a whole new class of gauged $U(1)_X$ models where the SM fermions are chiral under the new $U(1)_X$ symmetry which we call the Dark Hypercharge symmetry. We present a comprehensive set of solutions for gauge anomaly cancellation through the inclusion of three chiral dark sector fermions. We will focus on a particularly intriguing chiral solution and demonstrate, in a model-independent manner using only the Z' interaction channel, that the lightest dark fermion, is a viable Dark Matter candidate, and it can meet all current Dark Matter constraints. We also discuss the related Dark Matter and collider phenomenology of such models.

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