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Hunting All the Hidden Photons

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We explore the full constraining power of experimental bounds derived for hidden photons by applying them to gauge bosons of a weakly coupled $U(1)_{B-L}$, $U(1)_{L_\mu - L_\tau}$, $U(1)_{L_\mu - L_e}$ and $U(1)_{L_\tau - L_e}$. The associated gauge bosons of these anomaly-free groups are well-motivated mediators to a dark sector. In contrast to a hidden photon that acquires universal couplings to charged SM particles through kinetic mixing with the photon, several SM particles are uncharged under these gauge groups. Also taking into account loop-induced kinetic mixing the hidden photon bounds are drastically altered for the different gauge groups. We also discuss cosmological constraints and the sensitivity of future experiments.

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