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# Consistent Kinetic Mixing

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Extensions of the Standard Model (SM) with new Abelian gauge groups allow for kinetic mixing between the new gauge bosons and the hypercharge gauge boson, resulting in mixing with the photon. In many models the mixing with the hypercharge gauge boson captures only part of the kinetic mixing term with the photon, since the new gauge bosons can also mix with the neutral component of the $SU(2)_L$ gauge bosons. We take these contributions into account and present a consistent description of kinetic mixing for general Abelian gauge groups both in the electroweak symmetric and the broken phase. These contributions are relevant for *all* hidden photon models in which SM fermions are charged, like $U(1)_{B-L}, U(1)_{L_i-L_j}$, etc.
Based on these results we derive a low-energy theorem for the couplings of novel Abelian gauge bosons with the Standard Model Higgs boson from the one-loop kinetic mixing amplitudes.

## Abstract

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