Dark photon kinetic mixing effects for the CDF W-mass measurement

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A new $U(1)_X$ gauge boson X primarily interacting with a dark sector can have renormalizable kinetic mixing with the standard model (SM) $U(1)_Y$ gauge boson Y. This mixing besides introduces interactions of dark photon and dark sector with SM particles, it also modifies interactions among SM particles. The modified interactions can be casted into the oblique S, T and U parameters. We find that with the dark photon mass larger than the Z boson mass, the kinetic mixing effects can reduce the tension of the W mass excess problem reported recently by CDF from 7σ deviation to within 3σ compared with theory prediction. If there is non-abelian kinetic mixing between $U(1)_X$ and $SU(2)_L$ gauge bosons, in simple renormalizable models of this type a triplet Higgs is required to generate the mixing. We find that this triplet with a vacuum expectation value of order 5 GeV can naturally explain the W mass excess.

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