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Z boson mixing and the mass of the W boson

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We explore the possibility of explaining the W boson mass with an extra gauge boson mixing with the Z boson at tree level. Extra boson mixing with the Z boson will change the expression of the Z boson mass, thus altering the W boson mass. We explore two models in this work. We find that in the derivative portal dark matter model there are parameter spaces which can give the observed W boson mass, as well as the observed dark matter, relic density. These parameters' spaces can also fulfill the constraints from the electroweak oblique parameters and dark matter indirect detection. In the U(1) extension model, the kinetic mixing between extra boson and B boson can also give the observed W boson mass. However, to fulfill the electroweak oblique parameters' fit, the kinetic mixing in the U(1) model can only contribute about 27 MeV extra mass to the Standard Model W boson mass. Both models indicate the extra vector boson with the best fit mass around 120 GeV.

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