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New light vector bosons: electroweak precision measurements

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Focusing on the phenomenological constraints that precision measurements can provide on the gauge sector of the electroweak group, we aim to pursue a new precision program in which the most generic modifications due to new physics will be considered. We intend to apply this formalism to theories that extend the Standard Model gauge symmetry by a new Abelian group called $U(1)_X$. The gauge boson associated with $U(1)_X$ can mix with both the Standard Model Z boson and photon through the kinetic term. Furthermore, depending on how we choose to break this extra symmetry, the new gauge boson X can also have a mass mixing with them. Such mixings imply in three new eigenstates: the photon and Z boson we observe are now a mixture of the Standard Model fields and the X boson field. The same is true for the third observable eigenstate, which is known as Z' boson. In this work, we propose the Z' to be in the eV-GeV mass range. Such mass range has been of great interest to physicists since they realized new particles can be quite light and still have evaded discovery in particle accelerators. Our analysis consists in performing a global fit to LEP1 and LEP2 observables. This allows us to determine an exclusion region in the parameter space of our model and establish the mass range of the Z' boson consistent with current experimental data.

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