

Wikiprint Book

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W' Effective model

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Description of the model

This model is an extension of the SM, including additional interaction of fermions to a W' boson following the lowest-order effective Lagrangian described in Refs. [1] [2]:

$$\mathcal{L} = \frac{V'_{ij}}{2\sqrt{2}} \bar{f}_i \gamma_\mu \left(g'_{R_{i,j}} (1 + \gamma^5) + g'_{L_{i,j}} (1 - \gamma^5) \right) W'^\mu f_j + h.c.$$

where $g'_{R,L}$ are the right-handed (left-handed) W' -boson gauge couplings to fermions f_i and f_j , and V'_{ij} is either the CKM matrix or a diagonal matrix, for quarks and leptons respectively.

Model files

- weff.fr: the main model file.
- [WEff.nb](#): example of Mathematica notebook that loads the model, calculates the Feynman rules and extract the model files within the UFO format.
- [weff.ufo.tgz](#): The model files in UFO format (for MadGraph 5).

Notes:

- The W' -boson mass and width are set using the parameters MWp and WWp, respectively
- The left-handed (right-handed) W' -boson couplings to quarks and leptons are given by the matrices CLq and CLI (CRq and CRI) respectively. By default CLq and CRq are set to the CKM values and CLI and CRI are set to identity.
- The left-handed and right-handed W' -boson coupling constants are set by the parameters gL and gR. By default these values are set at 0.1.

Validation

The W' model was validated using MadGraph in the context of $W' \rightarrow tb$ searches at the LHC [3]:

- Several kinematical distributions of the W' decay products (including from top-quark decay) were checked, at the parton level or after showering (using Pythia). Variables sensitive to the W' chirality were studied (such as $\cos(\theta^*)$): the angle between the lepton in the top-quark rest frame and the top direction in the CM frame).
- The cross-sections calculated with this model were compared to theoretical values from [2]. Results for left- and right-handed W' were shown to be in very good agreement with LO calculations over all tested mass range (0.5 to 3.0 TeV).

References

- [1] Z. Sullivan, Fully differential W production and decay at next-to-leading order in QCD, Phys. Rev. (2002) 075011, [?arXiv:hep-ph/0207290](#) [hep-ph].
- [2] D. Duffy and Z. Sullivan, Model independent reach for W' -prime bosons at the LHC, Phys. Rev. D86 (2012) 075018, [?arXiv:1208.4858](#) [hep-ph].
- [3] ATLAS Collaboration, Search for $W' \rightarrow tb$ in proton-proton collisions at a centre-of-mass energy of $\sqrt{s} = 8$ TeV with the ATLAS detector (2013), [?ATLAS-CONF-2013-050](#)