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The W and Z boson spin observables as messengers of New Physics at LHC

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New Physics searches at colliders are usually conceived as the search of excesses in the number of events at a certain kinematic region. We emphasize that, whenever the process under study is mediated by a non-scalar particle, the final-state angular distribution has extra information related to the spin state of the mediator. We apply this
idea to the W and Z bosons at LHC, showing that their eight spin observables carry precious information about their production mechanism which is able to discriminate new physics and standard models. The characterization of these spin properties, which is feasible at LHC from the angular distribution of the lepton channels in their decays, may thus act as a messenger from the hidden new physics process in the hadronic environment.
We find the polarisation and alignment analisers in the different terms of the leptonic angular distribution, providing the accessibility to the eight multipole parameters. Furthermore we establish a biunivocal correspondence between these different spin properties of the vector boson and definite asymmetries or aplanarities.
The power of this analysis is well illustrated with several new physics production mechanisms, and their comparison with the standard model, for processes such as:(i) W production from polarised top quark decays;
(ii) W and Z bosons originating from the two-body decay of
a heavy resonance; (iii) Z production plus jets;
(iv) Z boson plus missing transverse energy.

Experimental Collaboration

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