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CheckMATE and SUSY-AI

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A key research question at the Large Hadron Collider (LHC) is the test of models of new physics. In this talk, we want to present two tools to recast direct LHC results to (any) BSM models. First, we discuss CheckMATE (Check Models At Terascale Energies) which is a program package which accepts simulated event files in many formats for any model. The program then determines whether the model is excluded or not at 95% C.L. by comparing to many recent experimental analyses at the LHC. It is simple to use and the program structure allows for easy extensions to upcoming LHC results in the future. CheckMATE can be found at: http://checkmate.hepforge.org.

Testing if a particular parameter set of such a model is excluded by LHC data is a challenge: It requires the time consuming generation of scattering events, the simulation of the detector response, the event reconstruction, cross section calculations and analysis code to test against several hundred signal regions defined by the ATLAS and CMS experiment.

In the second part of the talk, we attack this challenge using a novel approach. A Machine Learning tool has learned to predict within a fraction of a millisecond if a model is excluded or not directly from the model parameters.

A first example (SUSY-AI) is presented for the phenomenological Supersymmetric Standard Model (pMSSM). About 310,000 pMSSM model sets - each tested with 200 signal regions by ATLAS - have been used to train and validate SUSY-AI. The code is now able to reproduce the ATLAS exclusion regions in 19 dimensions with an accuracy of at least 97%

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