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Boosting probes of CP violation in the top Yukawa coupling with Deep Learning

Monday 4 November 2024 14:45 (45 minutes)

In this talk, I will discuss the CP properties of a Higgs boson coupling with a top quark pair, focusing on events where the Higgs state decays into a pair of b-quarks and the top-antitop system decays leptonically. The novelty of this analysis resides in the exploitation of two conditional Deep Learning (DL) networks: a Multi-Layer Perceptron (MLP) and a Graph Convolution Network (GCN). These models are trained for selected CPV phase values and then used to interpolate all possible values ranging from 0 to $\pi/2$. This enables a comprehensive assessment of sensitivity across all CP phase values, thereby streamlining the process as the models are trained only once. Notably, the conditional GCN exhibits superior performance over the conditional MLP, owing to the nature of graph-based Neural Network (NN) structures. Our Machine Learning (ML) informed findings indicate that assessment of the CP properties of the Higgs coupling to the $t\bar{t}$ pair can be within reach of the HL-LHC, quantitatively surpassing the sensitivity of more traditional approaches.

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