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Reinterpretation of the ATLAS Dark Meson analysis for Charged Higgs in the two-Higgs-doublet model

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The discovery of the neutral Higgs Boson of mass 125 GeV by the ATLAS and CMS experiments in 2012 has prompted further discussions on whether extensions of the Standard Model (SM) scalar sector exist, other than the observed SM doublet. The two-Higgs-doublet model (2HDM) is one of such extensions predicting the additional doublets. This model is supported by Supersymmetry and could provide the CP violation needed to explain the observed baryon asymmetry of the Universe. It predicts the appearance of two charged Higgs bosons that decay predominantly to top and bottom quarks for massive charged Higgs. Similar final states were addressed by a recent ATLAS search for hypothetical dark mesons using the full Run 2 pp collision dataset at $\sqrt{s} = 13$ TeV. These dark mesons could emerge from a $SU(2)$ dark flavour symmetry conserving model that is analogous to the SM Quantum Chromodynamics, and may decay back to SM fermions or gauge bosons. This analysis studied decays of dark mesons to top and bottom quarks which subsequently decay to fully-hadronic and the 1-lepton states. The similarities of decay products between the dark mesons and the charged Higgs makes the dark meson search potentially sensitive to the charged Higgs signal. This talk will explore the feasibility of searching for the charged Higgs signals using the existing dark meson analysis.

Mini Symposia (Invited Talks Only)

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