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Electroweak Phase Transition in the 2HDM

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The nature of the electroweak phase transition in two-Higgs-doublet models is revisited in light of the recent LHC results. A scan over an extensive region of their parameter space is performed, showing that a strongly first-order phase transition favours a light neutral scalar with SM-like properties, together with a heavy pseudo-scalar and a mass hierarchy in the scalar sector. Altogether, the findings indicate that the exotic decay $A^0 \rightarrow Z H^0$ would be a 'smoking gun' signature of these scenarios at LHC. We analyse the LHC search prospects for this decay in the $\ell\ell b\bar{b}$ and $\ell\ell W^+W^-$ final states, arguing that current data may be sensitive to this signature in the former channel as well as there being great potential for a discovery in either one at the very early stages of the 14 TeV run.

Primary authors: CARVALHO DORSCH, Glauber (University of Sussex); NO, Jose M. (University of Sussex); MIMASU, Ken (University of Sussex); HUBER, Stephan (University of Sussex)

Presenter: CARVALHO DORSCH, Glauber (University of Sussex)

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