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Probing CP-violation and thermal history of our Universe with Higgs physics

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Searching for new sources of CPV and uncovering the mechanism behind EWSB are cornerstones of the LHC program and forthcoming experiments, such as FCC and LISA. First, we show how collider measurements and observations of stochastic gravitational-wave signals can complement each other to explore the multiform scalar potential in the 2HDM. The well-motivated 2HDM leads to a rich phase transition, favoring SFOEWPT below the TeV scale, with the smoking gun signature of scalar resonant searches to top pairs. Second, we show the prospects of directly probing CPV in the Higgs-top coupling. In particular, we use machine learning techniques to uplift the analysis from a raw rate to a polarization study.

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