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Intermediate Charge-Breaking Phases in the 2HDM

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Content :

The evolution of the early Universe around the electroweak epoch is an ideal testbed for physics beyond the Standard Model and in particular extended scalar sectors. The Universe may have experienced a sequence of phases of exotic nature, one of these being an intermediate phase where the electromagnetic charge is not conserved.

In my talk, intermediate $U(1)_\mathrm{em}$ charge-breaking (CB) phases in the CP-conserving 2-Higgs Doublet Model will be investigated. While previously studied only in the approximation of high temperatures, the possibility for their existence in the one-loop effective potential including thermal corrections is confirmed. I will discuss the relation of CB phases with the (non-)restoration of the electroweak $SU(2)\times U(1)$ symmetry at high temperatures, and the consistency with current collider data. For certain selected benchmark scenarios, the features of a CB phase in the evolution of the vacuum will be examined, such as the occurrence of a first-order phase transition to the CB phase from the neutral one.

Primary authors : AOKI, Mayumi (Kanazawa University) ; BIERMANN, Lisa (KIT) ; Dr. BORSCHENSKY, Christoph (Karlsruhe Institute of Technology) ; Prof. IVANOV, Igor (Sun Yat-sen University, China) ; Prof. MÜHLLEITNER, Milada Margarete (KIT) ; Mr. SHIBUYA, Hiroto (Kanazawa University)

Co-authors :

Presenter : Dr. BORSCHENSKY, Christoph (Karlsruhe Institute of Technology)

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