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## Maximal Entanglement and Symmetries in the 2HDMs

We consider 2-to-2 scatterings of Higgs bosons in a CP-conserving two-Higgs-doublet model (2HDM) and study the implication of maximizing the entanglement in the flavor space. In the unbroken phase and turning off the gauge interactions, entanglement maximization results in the appearance of an U(2) x U(2) global symmetry. Interestingly, once the Higgs bosons acquire vacuum expectation values, maximal entanglement enforces an exact U(2)xU(2) symmetry, which is spontaneously broken to U(1) x U (1). As a byproduct, this gives rise to Higgs alignment as well as to the existence of 6 massless Nambu-Goldstone bosons. The U(2)xU(2) symmetry can be gauged to lift the massless Goldstones, while maintaining maximal entanglement demands the presence of a discrete Z2 symmetry interchanging the two gauge sectors. The model is custodially invariant in the scalar sector, and the inclusion of fermions requires a mirror dark sector, related to the standard one by the Z2 symmetry.

Author: Prof. WAGNER, Carlos (University of Chicago)Presenter: Prof. WAGNER, Carlos (University of Chicago)Session Classification: Higgs theory and experiment

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