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Testing CP-violation in Heavy Scalar Sector at Future Muon Colliders

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We propose a model-independent approach to test for CP (Charge-Parity)-violation in the scalar sector. We simply extend the Standard Model (SM) by introducing a heavy neutral scalar particle and the couplings of h_2VV ($V = W^{\pm}, Z$) and h_2h_1Z vertices, where h_1, h_2 stand for the 125 GeV SM Higgs boson and the heavy neutral scalar particle we add respectively. This is possible at the future muon collider by exploiting h_2 production from Vector-Boson Fusion (VBF) and decay to h_1Z. When the coupling parameters at the vertices h_2VV ($V = W^{\pm}, Z$) and h_2h_1Z are both nonzero, CP-violation exists in the scalar sector. We simulate the signal and backgrounds for the processes mentioned above at the future muon colliders with the $\sqrt{s}$ = 10 TeV (3 TeV) and the integrated luminosity of 10 ab^{-1} (0.9 ab^{-1}). Finally, we provided the discovery potential of CP-violation under different coupling parameters.

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