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Muon Electric Dipole Moment as a Probe of Flavor-Diagonal CP Violation

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Electric dipole moments (EDMs) of elementary particles are powerful probes of new physics with flavor-diagonal CP violation. The reported discrepancy in the muon anomalous magnetic moment motivates us to explore to what extent new physics with flavor-diagonal CP violation to address the discrepancy is probed by searches for the muon EDM. As a benchmark, we focus on a CP-violating two-Higgs-doublet model to explain the muon $g-2$ anomaly where the muon exclusively couples to one Higgs doublet. Since contributions to flavor violating processes as well as the electron EDM are suppressed, the muon EDM becomes an essential probe of the model. Our result shows that some viable parameter space leads to the muon EDM of around $d_\mu \simeq 6 \times 10^{-23}\, e\,\mathrm{cm}$ probed by the PSI experiment and most of the parameter space is covered by the proposed J-PARC experiment.

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