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Chromomagnetic and chromoelectric dipole moments of the top quark in the fourth-generation THDM

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The chromomagnetic dipole moment (CMDM) and chromoelectric dipole moment (CEDM) of the top quark are calculated at the one-loop level in the framework of the two-Higgs doublet model with four fermion generations (4GTHDM), which is still consistent with experimental data and apart from new scalar bosons (H^0, A^0, and $H^\pm$) and quarks (b' and t') predicts new sources of CP violation via the extended 4×4 CKM matrix. Analytical expressions for the CMDM and CEDM of a quark are presented both in terms of Feynman parameter integrals, which are explicitly integrated, and Passarino-Veltman scalar functions, with the main contributions arising from loops carrying the scalar bosons accompanied by the third- and fourth-generation quarks. The current bounds on the parameter space of the 4GTHDM are discussed and a region still consistent with the LHC data on the 125 GeV Higgs boson and the oblique parameters is identified. It is found that the top quark CMDM, which is induced by all the scalar bosons, can reach values of the order of 10^{-2}–10^{-1}. As for the top quark CEDM, it only receives contributions from the charged scalar boson and can reach values of the order of 10^{-20}–10^{-19} ecm for relatively light $m_{H^\pm}$ and heavy $m_{b'}$, with the dominant contribution arising from the b quark. The CEDM would be the most interesting prediction of this model as it can be larger than the value predicted by the usual THDMs by one order of magnitude.

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