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Top Yukawa Coupling Measurement at High Energy Muon Collider

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Top Yukawa coupling is deeply connected to many fundamental puzzles in Higgs and Electroweak physics. In this study, we seek to measure the Top Yukawa coupling at the future high-energy muon colliders utilizing the Higgs unitarization in the $V_L V_L \rightarrow t\bar{t}$ process. If the Top Yukawa coupling deviates from the Standard Model (SM) value, the amplitude of the processes with gauge bosons and top quarks $VV \rightarrow t\bar{t}$ will be increasing and it will deviate from the SM rate as a function of the $t\bar{t}$ center of mass energy. We show that using a muon collider with 10TeV energy and 10ab^{-1} integrated luminosity, the collider can probe the Top Yukawa with a precision better than 1.5%. This is a significant improvement from the projected high-luminosity LHC (HL-LHC) limit of 3.2% and the $t\bar{t}H$ process sensitivity at muon colliders.

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