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Probing the top Yukawa coupling at the LHC via associated production of single top and Higgs YA-JUAN ZHENG, University of Kansas — We study Higgs boson production associated with single top or anti-top via t-channel weak boson exchange at the LHC. The process is an ideal probe of the top quark Yukawa coupling, because we can measure the relative phase of htt and hWW couplings, thanks to the significant interference between the two amplitudes. By choosing the emitted W momentum along the polar axis in the $th(\bar{t}h)$ rest frame, we obtain the helicity amplitudes for all the contributing subprocesses analytically, with possible CP phase of the Yukawa coupling. We study the azimuthal asymmetry between the W emission and the $Wb(\bar{b}) \to t(\bar{t})h$ scattering planes, as well as several t and t polarization asymmetries as a signal of CP violating phase in the htt coupling. Both the azimuthal asymmetry and the polarization perpendicular to the scattering plane are found to have the opposite sign between the top and anti-top events. We identify the origin of the sign of asymmetries, and propose the possibility of direct CP violation test in pp collisions by comparing the top and anti-top polarization at the LHC.

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