

Charged Higgs Boson Search via $e^+e^- \rightarrow H^+H^- \rightarrow c\bar{c}b$ at Linear Colliders

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We study charged Higgs boson search via $e^+e^- \rightarrow H^+H^- \rightarrow c\bar{c}b$ at the 500 GeV ILC. In a general two Higgs doublet model without Z_2 symmetry, extra Yukawa couplings ρ_{tt} and ρ_{tc} can drive baryogenesis, but searches at the HL-LHC may still go empty-handed if the couplings are relatively weak. Taking $m_{H^\pm} \simeq m_H \simeq m_A \sim 200$ GeV, with ρ_{tt} , $\rho_{tc} \sim 0.1$ and no $h(125)$ - H mixing, $H^+ \rightarrow c\bar{b}$ decay is dominant, and the $c\bar{c}b$ final state is likely overwhelmed by QCD background at the LHC. We show that the electroweak production of H^+H^- at the ILC is discoverable with integrated luminosity of 1 ab^{-1} . We show further that m_{H^\pm} can be extracted by requiring the two pairs of b and light jets be roughly equal in mass, without assuming the mass value. Thus, ILC can probe low mass Higgs bosons in multijet final states to complement HL-LHC in the future.

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