ECFA Topic: Exotic Top Decays

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- Previous BSM searches related to top physics at e^+e^- colliders
- New research direction
- Main phenomenological target
- ILD Status and Plans

ILD Meeting, 16-01-24

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Previous BSM searches related to top physics at e^+e^- colliders

Mainly concentrated on an effective field theory (or anomalous couplings)

- Microscopic details of new physics characterized by masses larger than the energy scales experimentally accessible
- Includes modified EW and flavor-conserving contact interactions, as well as flavor-changing neutral currents (FCNCs), negligible small at the SM
- Potential of new lepton colliders on top-quark FCNC decays may be limited in common models (due to other observable consequences implied)

Determine a new direction where e^+e^- colliders could offer advantages with respect to hadron colliders

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New research direction

Top-quark decays into new physics particles

- Foreseen in well motivated models of new physics
- Experience less tight experimental constraints from other searches
- Have received little attention so far at both e^+e^- and hadron colliders

Focus on scenarios that would be challenging for the LHC/HL-LHC

New state in the mass range (light) or in final states not currently investigated at the LHC

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Main phenomenological target

$t \rightarrow \phi q, \phi \rightarrow b\bar{b}$

- Particularly interesting for ϕ with small coupling to Z boson
- Considering $\phi \neq h$ frees up from constraints, keeping h as a particular case
- Plenty room for improvement in e^+e^- colliders with respect to LHC, particularly for small masses (profit from trigger-less operation)

Quantify the discovery reach of the e^+e^- colliders below the HL-LHC limits at BR($t \rightarrow \phi q$) ≤ 10^{-4} in the channel $\phi \rightarrow b\bar{b}$ and mass range m_ϕ= [10,172] GeV

Study the possible precisions on mass and other ϕ properties

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ILD Status and Plans

- FCC-ee studies currently going on using DELPHES and planning to move to more realistic detector simulation in Key4hep
- Previous CLIC studies focused on $\phi = h$ (arXiv:1801.04585)
- Nothing specifically done at the ILD/ILC in this direction

We aim to find people willing to do some work with the ILD on this topic

Interesting to figure out the possible profit of ECM > 350 GeV and polarisation in both beams

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