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## Measuring the anomalous $ttZ$ and $tt\gamma$ couplings at Future $e-p$ colliders.

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We investigate the anomalous  $ttX$  couplings for neutral charged gauge boson  $X=Z/\gamma$  in the Standard Model (SM) and measure their precision beyond the SM in future electron-proton collider environments. The  $tt$  quark pairs are produced in the neutral currents channel through the process  $e^+p \rightarrow t\bar{t}$ , for electron and proton beams of energy  $E_e = 60$  GeV and  $E_p = 7$  TeV respectively, at the center of mass energy of 1.3 TeV as proposed for the LHeC. The  $ttX$  interaction is further probed through the photo-production process  $\gamma p \rightarrow t\bar{t}$  with  $\gamma$  scattered from the electron. We focus on the semileptonic channel where  $t \rightarrow bW^+$ ,  $W^+ \rightarrow l^+\nu_l$  and  $\bar{t} \rightarrow \bar{b}W^-$ ,  $W^- \rightarrow l^-\bar{\nu}_l$  and investigate sensitive kinematic observables to these couplings. We observe that the azimuthal angular difference,  $\Delta\Phi$ , between the scattered electron and the  $l^+\nu_l$  is the most sensitive observable to  $ttZ$  couplings. We further investigate sensitive kinematic observables to  $tt\gamma$  couplings in the photo-production process. We perform a  $\chi^2$  analysis at the inclusive and differential levels in the cross section to constrain the couplings.

### Apply for student award at which level:

None

### Consent on use of personal information: Abstract Submission

Yes, I ACCEPT

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