SEARCH FOR NEW PHYSICS IMPACTING ASSOCIATED TOP PRODUCTION IN MULTILEPTON FINAL STATES USING THE FRAMEWORK OF EFFECTIVE FIELD THEORY

Abstract

by

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This thesis presents a search for new physics impacting top quarks within the context of an effective field theory (EFT). Parameterizing potential new physics effects in terms of 26 dimension-six EFT operators, six associated top production processes are studied. The analysis targets the leptonic signatures of these processes, requiring the selected events to contain two leptons of the same charge or three or more leptons. In order to gain sensitivity to EFT effects by differentiating the admixture of processes and effects in each category, the events are subcategorized and binned in terms of kinematical distributions. The predicted distribution in each category is compared to the experimentally observed distribution, using 138 fb^{-1} of proton-proton collision data collected by the CMS experiment from 2016 to 2018. A likelihood fit of the 26 EFT parameters to the observed data is performed to extract the one and two standard deviation confidence intervals for the EFT parameters. While the results are consistent with the standard model prediction, the extracted limits can help to constrain theoretical models of new physics; interpreted in terms of the energy scale probed by the experiment, the results can also provide information about the energy frontier beyond which new physics discoveries may yet lie.