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The discovery of the Higgs boson in 2012 opened a new field for exploration in the realm of particle physics. To better understand the Standard Model of particle physics, it is of prominent interest to study the Yukawa coupling of the Higgs boson to the top quark y_t.

The only way of directly measuring both the magnitude and sign of y_t at LHC is via the production of a Higgs boson with a single top quark. In this work, a search for the tHq production is presented in a final state with two light-flavoured-charged leptons (electrons or muons) and one hadronically-decaying tau lepton (named $2\ell + \tau_{had}$ channel). This analysis uses an integrated luminosity of 140fb^{-1} of proton-proton collision data at a centre-of-mass energy of 13 TeV collected by the ATLAS detector during LHC Run 2. This search for the tHq production in the $2\ell + \tau_{had}$ channel is an important contribution to the exploration of the Higgs-top quark Yukawa coupling and a step forward in

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