

# Measurements of associated top quark production and searches for new top-quark phenomena with the ATLAS detector

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The high center-of-mass energy of proton-proton collisions and the high integrated luminosities at the CERN Large Hadron Collider make it possible to study rare processes of the Standard Model (SM) with unprecedented precision and search for new physics that might enhance extremely rare processes in the SM. Measurements of rare SM processes provide new tests of the SM predictions with the potential to unveil discrepancies with the SM predictions or provide important input for the improvement of theoretical calculations. A significant example of new phenomena are Flavour Changing Neutral Currents (FCNC): forbidden at tree level and highly suppressed at higher orders in the Standard Model (SM), FCNC processes can receive enhanced contributions in many extensions of the SM, so any measurable sign of such interactions is an indication of new physics. In this talk, total and differential measurements of top-quark production in association with additional bosons are shown using data taken with the ATLAS experiment at a center-of-mass-energy of 13 TeV, as well as a recent result on the evidence for the very rare process of four-top-quark production, combining several channels.

In addition, searches for FCNCs with the ATLAS experiment are shown, including a new result on the FCNC coupling of the top quark to the Z boson using the full data taken during Run-2 of the LHC, as well as other searches for beyond-the-Standard-Model phenomena in top-quark final states.

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