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Evidence for top quark production in nucleus-nucleus collisions with the CMS experiment

Monday, 1 June 2020 11:00 (20 minutes)

Evidence for the production of top quarks in heavy ion collisions is reported in a data sample of lead-lead collisions recorded in 2018 by the CMS experiment at a nucleon-nucleon center-of-mass energy of $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV, corresponding to an integrated luminosity of $1.7 \pm 0.1\,\mathrm{nb}^{-1}$. Top quark pair ($\mathrm{tt}$) production is measured in events with two opposite-sign high-p_{T} isolated leptons ($\ell^{\pm}\ell^{\mp} = \mathrm{e}^{+}\mathrm{e}^{-}$, $\mu^{+}\mu^{-}$, and $\mathrm{e}^{\pm}\mu^{\mp}$). We test the sensitivity to the tt signal process by requiring or not the additional presence of b-tagged jets, and hence the feasilibilty to identify top quark decay products irrespective of interacting with the medium (bottom quarks) or not (leptonically decaying W bosons). To that end, the inclusive cross section (σ_{tt}) is derived from likelihood fits to a multivariate discriminator, which includes different leptonic kinematic variables, with and without the b-tagged jet multiplicity information. The observed (expected) significance of the tt signal against the background-only hypothesis is 4.0 (6.0) and 3.8 (4.8) standard deviations, respectively, for the fits with and without the b-jet multiplicity input. After event reconstruction and background subtraction, the extracted cross sections are $\sigma_{\mathrm{tt}} = 2.02 \pm 0.69$ and $2.56 \pm 0.82\,\mu\mathrm{b}$, respectively, which are consistent with each other and lower than, but still compatible with, the expectations from scaled proton-proton data as well as from perturbative quantum chromodynamics predictions. This measurement constitutes the first step towards using the top quark as a novel tool for probing strongly interacting matter.

Collaboration (if applicable)

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