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Observation of top quark pair production in nucleus-nucleus collisions with the CMS detector

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The high energies available at the CERN LHC have opened up the possibility to measure various large-mass elementary particles for the first time in heavy ion collisions. The first observation of top quark pair ($t\bar{t}$) production is reported using lead-lead collisions recorded in 2018 by the CMS experiment at a nucleon-nucleon center-of-mass energy of $\sqrt{s_{NN}} = 5.02$ TeV. The data sample corresponds to an integrated luminosity of about 1.7 nb^{-1} . Dilepton events ($e^\pm\mu^\mp$, $\mu^\pm\mu^\mp$, and $e^\pm e^\mp$) are selected, and the inclusive cross section ($\sigma_{t\bar{t}}$) is measured from a likelihood fit to a multivariate discriminator using lepton kinematic variables. The $\sigma_{t\bar{t}}$ measurement is additionally performed in categories defined using the multiplicity of jets and b-tagged jets, which improve the sensitivity to the $t\bar{t}$ signal process. Top quark production in heavy ion collisions is a novel tool for probing the nuclear parton distribution functions, the mechanisms of parton energy loss, and the medium opacity at different space-time scales.

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