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Evidence for top quark production in nucleus-nucleus collisions[1]

GEORGIOS KRINTIRAS, Univ of Kansas, CMS COLLABORATION — Droplets of quark-gluon plasma (QGP), an exotic state of strongly interacting quantum chromodynamics matter, are routinely produced in heavy nuclei high-energy collisions. Although the experimental signatures marked a paradigm shift away from expectations of a weakly coupled QGP, a challenge remains as to how the locally deconfined state with a lifetime of a few fm can be resolved. A colored particle that decays mostly within the QGP is the top quark. Here we demonstrate, for the first time, that top quark decay products are identified, irrespective of whether interacting with the medium (bottom quarks) or not (leptonically decaying W bosons). Using lead-lead collision data recorded by the CMS detector, we report evidence for top quark pair production. Dilepton final states are selected, and the cross section is measured from a likelihood fit to a multivariate discriminator using lepton kinematic variables. The measurement is additionally performed considering the jets originating from the hadronization of bottom quarks, which improve the sensitivity to the signal process. The measurements, consistent with each other and the expectations from scaled proton-proton data as well as perturbative QCD, constitute the first step towards using the top quark as a novel tool to probe QGP.

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