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Observation of a Strange Muonic Atom and Its Antimatter in Heavy-Ion Collisions at STAR

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The discovery of exotic muonic atoms, including muonic antihydrogen and muonic kaon atoms, constitutes a milestone in our ability to make and study new forms of matter. The unique environment of relativistic heavy-ion collisions, characterized by the abundant production of muons alongside other charged particles, provides a promising platform for the formation and detection of these exotic atomic systems.

In this talk, we will report the observation of a new muonic atom composed of a muon bound to a kaon meson containing a strange quark. These strange muonic atoms and their antimatter counterparts are produced in isobar Ru+Ru and Zr+Zr collisions at $\sqrt{s_{\mathrm{NN}}}$ = 200 GeV and detected using the STAR detector at the Relativistic Heavy Ion Collider (RHIC). These measurements are used to directly determine the lepton production source size and to extract the yield of primordial low-p_T muons originating from the Quark Gluon Plasma (QGP) created in heavy-ion collisions.

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