

Search for Muonic Atoms at RHIC

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In ultrarelativistic heavy-ion collisions with high particle multiplicities, a produced muon can be bound to a charged hadron (proton, antiproton, K^+ , K^- , π^+ , π^-) by Coulomb force and form a hydrogen-like atom. Among these atoms, the antimatter muonic hydrogen and the $K - \mu$ atom have been predicted but not yet been discovered. At the STAR experiment, muon identification at low transverse momentum provides a great opportunity to search for a variety of muonic atoms. Muonic atoms are an ideal tool, as suggested by Mel Schwartz, Jack Sandweiss and many other theorists, to determine the thermal emission from the Quark-Gluon Plasma via a direct measurement of the single muon spectrum because only thermal muons or muons from short-lived resonance decays are capable of forming such atoms. We will present the analysis on the $\sqrt{s_{NN}} = 200$ GeV Au+Au collisions collected by the STAR experiment at RHIC. We will show the possible signatures of the new muonic atoms extracted from invariant mass distributions and also from particle correlations. We will also show the procedure that we use to extract the fraction of primordial muons.

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