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Statistical Hadronization Model Calculations of Heavy Flavor Hadron Production in Relativistic Heavy-Ion Collisions at RHIC and the LHC

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The validity of the Statistical Hadronization Model (SHM) has been successfully tested to adequately reproduce hadronic particle abundances over nine orders of magnitude in high energy collisions of heavy ions. Assuming a thermally equilibrated system, experimental particle yields at RHIC and the LHC serve as an anchor for the determination of common freeze-out parameters in the QCD phase diagram – namely, the baryon chemical potential (μ_{B}) and the chemical freeze-out temperature (T_{ch}) – via thermal fits in the SHM framework. Heavy flavor particle production is of particular interest in heavy ion phenomenology by virtue of the large difference between the mass of the bare heavy quarks and the calculated pseudocritical hadronization temperature. Due to their large masses, heavy quarks are produced in the initial hard partonic scattering of heavy ion collisions. The produced charm and beauty quarks then interact with other constituents of the collision fireball and then potentially thermalize. These heavy quarks can then recombine with the surplus of deconfined light flavor quarks in the Quark-Gluon Plasma generated in a heavy ion collision; where the total number of constituent heavy quarks is assumed to stay constant until hadronization is reached. This thermal-like behavior of final state heavy flavor hadron yields allows for their production to be modeled in the context of the SHM using an additional fugacity parameter. In this contribution, we will show recent thermal fits to single charm hadrons measured in ALICE Pb+Pb Collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV and STAR Au+Au Collisions at $\sqrt{s_{\mathrm{NN}}}$ = 200 GeV utilizing the same PDG2016+ hadronic spectrum as our previous work and a modified version of the most recent PDG2022 list. We will additionally show thermal model predictions of heavy quarkonia, and beauty and multi-charm hadron yields as a function of $\sqrt{s_{\mathrm{NN}}}$ and test their sensitivity to different values of T_{ch} and μ_{B}.

Category

Theory

Collaboration (if applicable)

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