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Modeling and Analysis of Ultrarelativistic Heavy Ion Collisions[1]

WILLIAM MCCORMACK, University of Notre Dame/ Michigan State University, SCOTT PRATT, Michigan State University — High-energy collisions of heavy ions, such as gold, copper, or uranium serve as an important means of studying quantum chromodynamic matter. When relativistic nuclei collide, a hot, energetic fireball of dissociated partonic matter is created; this super-hadronic matter is believed to be the quark gluon plasma (QGP), which is theorized to have comprised the universe immediately following the big bang. As the fireball expands and cools, it reaches freeze-out temperatures, and quarks hadronize into baryons and mesons. To characterize this super-hadronic matter, one can use balance functions, a means of studying correlations due to local charge conservation. In particular, the simple model used in this research assumed two waves of localized charge-anticharge production, with an abrupt transition from the QGP stage to hadronization. Balance functions were constructed as the sum of these two charge production components, and four parameters were manipulated to match the model's output with experimental data taken from the STAR Collaboration at RHIC. Results show that the chemical composition of the super-hadronic matter are consistent with that of a thermally equilibrated QGP.

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