PHYSICS AND ASTRONOMY COLLOQUIUM

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Probing the Quark Gluon Plasma with the STAR Experiment at RHIC

By accelerating and colliding heavy ions at very large energies, the Relativistic Heavy Ion Collider (RHIC) provides the laboratory for studying nuclear matter under extreme conditions. Under such conditions, the matter is expected to undergo a phase transition, "melting" the protons and neutrons into their fundamental constituents, quarks and gluons. To study the properties of this Quark Gluon Plasma (QGP) phase, we need "probes": particles created early in a heavy-ion collision which experience the full evolution of the collision, including the hottest and densest phases of the created medium. Particles resulting from scatterings of energetic quarks and gluons with a large momentum transfer ("hard scatterings") upon initial impact of the incoming nuclei provide one such probe. In-medium modifications of "jets", the particles originating from hard scatterings, are studied to gain tomographic information about the structure/properties of the matter. Another intriguing probe is heavy quarkonium, i.e., mesons made up of a heavy quark and its anti-quark (charm or bottom). The binding of heavy quarkonia is particularly sensitive to the deconfinement nature of the fundamental strong force in the QGP.

RHIC, at Brookhaven National Laboratory, has been providing high-energy heavy-ion collisions since the year 2000. New sub-detectors within the STAR experiment, the Solenoidal Tracker at RHIC, are capitalizing on the high collision rates currently provided by RHIC, allowing the experiment to select and record rare probes. The most recent measurements of jets and heavy quarkonia at the STAR experiment will be presented and discussed.

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