Contribution ID: **14** Type: **not specified**

Production and nuclear modification of B_c mesons in relativistic heavy-ion collisions

Recent measurement on nuclear modification of B_c mesons at the LHC serves as a novel probe of heavy quark interaction with the QGP in relativistic heavy-ion collisions. Based on a linear Boltzmann transport model that incorporates both perturbative (Yukawa) and non-perturbative (string) interactions between heavy quarks and the QGP, we study the production and nuclear modification of B_c in these energetic nuclear collisions. A B_c bound state dissociates while one of its constituent heavy quark scatters with the QGP with momentum transfer greater than its binding energy. The medium-modified charm and bottom quarks can recombine into B_c mesons via the coalescence model, while the modified bottom quarks can also produce B_c mesons through fragmentation. We find that the dissociation, recombination, and fragmentation processes are sensitive to the interaction dynamics of heavy quarks with the QGP. Within the current kinematic range observed at the LHC, the string interaction leads to much stronger dissociation of B_c than the Yukawa interaction. Different types of interactions also yield different medium-modified spectra of open heavy quarks, which further affect the B_c spectrum from recombination and fragmentation. Furthermore, the recombination process of B_c mesons is highly sensitive to the volume of the QGP. We provide a satisfactory description of the nuclear modification factor of B_c mesons in Pb+Pb collisions at 5.02 ATeV, as well as predictions for Au+Au collisions at 200 AGeV. More precise experimental data on B_c in the future can provide a more stringent constraint on heavy quark dynamics in high-energy nuclear collisions, and may also shed light on the inner structure of B_c mesons.

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