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Nuclear modification of B_c mesons in relativistic heavy-ion collisions based on a linear Boltzmann transport model

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The nuclear modification factor ($R_{\rm AA}$) of B_c mesons in high-energy nuclear collisions provides a novel probe of heavy quark interactions with the quark-gluon plasma (QGP) medium. Based on a linear Boltzmann transport model that incorporates both Yukawa and string types of interactions between heavy quarks and the QGP, we study the production and evolution of heavy quarks and B_c mesons within the same framework. A B_c bound state dissociates while one of its constituent heavy quarks 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, and the medium-modified bottom quarks can also fragment to B_c mesons. We find that most primordial B_c mesons produced by the initial hard collisions dissociate inside the QGP. The B_c production is dominated by recombination at low transverse momentum, while it is dominated by fragmentation at high transverse momentum. The string interaction dominates over the Yukawa interaction in the nuclear modification of B_c mesons. The participant number dependence of the B_c meson $R_{\rm AA}$ is determined by the complicated interplay between the heavy quark yield, energy loss, and the QGP volume. We obtain a reasonable description of the $R_{\rm AA}$ of B_c mesons in Pb+Pb collisions at $\sqrt{s_{\rm NN}} = 5.02$˜TeV, and provide predictions for Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$˜GeV.

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