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Mass hierarchy of heavy quark energy loss within a perturbative-non-perturbative transport model

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The general intuition that heavier partons suffer weaker energy loss inside a quark-gluon plasma (QGP) medium is critically re-examined. Within a linear Boltzmann transport model that includes both Yukawa and string types of interactions between heavy quarks and the QGP, we find that while the radiative energy loss is suppressed by the parton mass, heavier partons can experience stronger string potential scatterings with the medium. Their competition may result in less energy loss of bottom quarks than charm quarks at low transverse momentum (p_{T}) but an inverse order at high p_{T}. Our model calculation shows a weaker nuclear modification on bottom particles than charm particles at low p_{T}, as observed by both RHIC and LHC experiments, but predicts an opposite hierarchy at high p_{T}. A larger momentum space transport coefficient ($\hat{q}$) and a smaller spatial diffusion coefficient (D_{s}) are found for bottom quarks than for charm quarks.

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