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Bottomonium suppression and elliptic flow from real-time quantum evolution

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We compute the suppression and elliptic flow of bottomonium using real-time solutions to the Schroedinger equation with a realistic in-medium complex-valued potential. To model the initial production, we assume that, in the limit of heavy quark masses, the wave-function can be described by a lattice-smeared (Gaussian) Dirac delta wave-function. The resulting final-state quantum-mechanical overlaps provide the survival probability of all bottomonium eigenstates. Our results are in good agreement with available data for R_{AA} as a function of $N_{\rm part}$ and p_T collected at $\sqrt{s_{\rm NN}} =$ 5.02 TeV. In the case of v_2 for the various states, we find that the path-length dependence of $\Upsilon(1s)$ suppression results in quite small v_2 for $\Upsilon(1s)$. Our prediction for the integrated elliptic flow for $\Upsilon(1s)$ in the $10{-}90\backslash\%$ centrality class is $v_2[\Upsilon(1s)] = 0.0026 \pm 0.0007$. We additionally find that, due to their increased suppression, excited bottomonium states have a larger elliptic flow and we make predictions for $v_2[\Upsilon(2s)]$ and $v_2[\Upsilon(3s)]$ as a function of centrality and transverse momentum. Similar to prior studies, we find that it is possible for bottomonium states to have negative v_2 at low transverse momentum.

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