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Charmonia production by coalescence in heavy ion collisions

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We study charmonium states, J/ψ , $\psi(2S)$, and $\chi_{c1}(1P)$ mesons in heavy ion collisions by focusing on their production from the charm and anti-charm quarks in a quark-gluon plasma by coalescence. Starting from the investigation of the difference in their internal structures or different wave functions of charmonium states, we calculate the yield and transverse momentum distributions of charmonium states produced in heavy ion collisions. Then, we also discuss the flow harmonics, or elliptic and triangular flow of charmonium states using the transverse momentum distribution of charmonium states. We find that the internal structure differences, as well as feed-down contributions of charmonium states, are averaged out for elliptic and triangular flow, resulting in similar elliptic and triangular flow for all charmonium states. We investigate further the elliptic and triangular flow of charmonium states at low transverse momentum regions and also discuss the quark number scaling of elliptic and triangular flow for charmonium states in heavy ion collisions.

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