Spin asymmetry of J/ψ in peripheral Pb+Pb collisions at LHC

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By generalizing the statistical hadronization model [1,2] to the spin degree of freedom, we have calculated the influence of the magnetic field existing in the early stage of peripheral heavy ion collisions on the spin asymmetry of produced J/ψ at the LHC energy [3]. The fraction of J/ψs with spin in the direction of the magnetic field (J_y = 0) is found to be above 1/3 and to increase in peripheral Pb+Pb collisions with the transverse momentum in the color singlet model (CSM) [4] scenario, while it is 1/3 in the color octet model (COM) [5] scenario as shown in Fig. 1. In the absence of vanishing J/ψ spin flipping cross section (ε=0), the fraction can be as large as 0.42 for J/ψ of transverse momentum p_T around 10 GeV. Even if the J/ψ flipping cross section is the same as the dissociation cross section (ε=1), the fraction can still be above 0.39 at p_T = 10 GeV. For a more realistic value of J/ψ spin flipping cross section, which would be strongly model dependent, the spin fraction is expected to lie between these two extreme cases. Our finding thus indicates that studying the spin asymmetry of J/ψ produced in relativistic heavy ion collisions provides the information on how the J/ψ is produced in initial hard collisions.

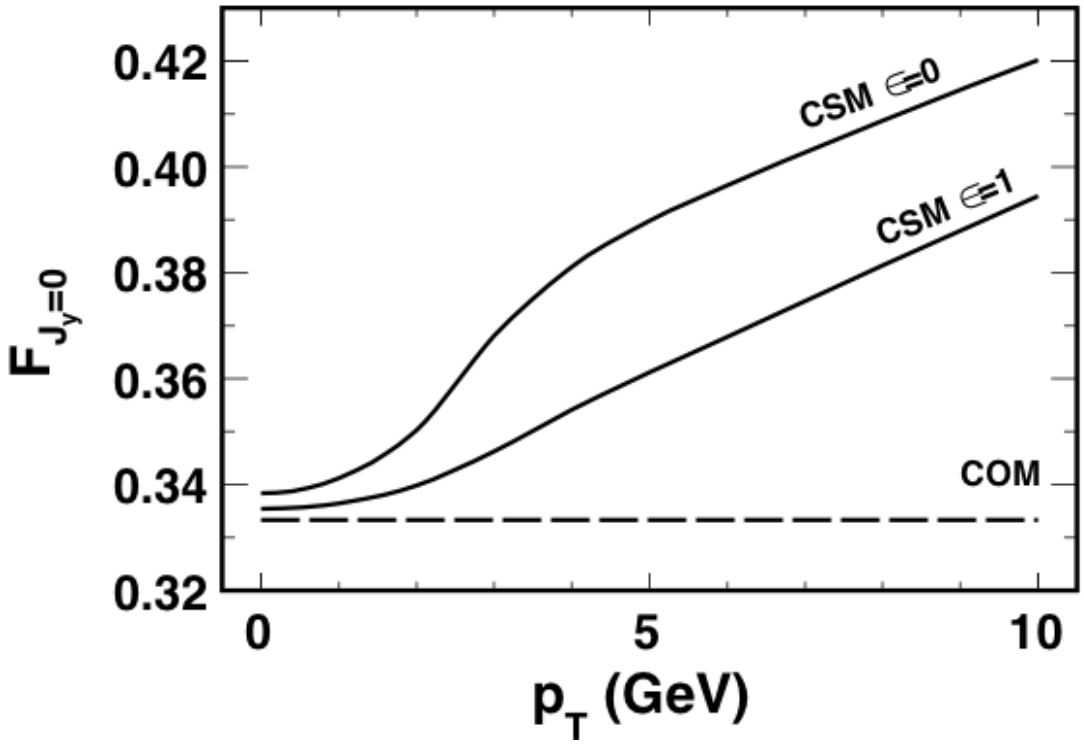

FIG. 1. Transverse momentum dependence of the fraction of J/ψs with spin along the direction of the magnetic field in peripheral Pb+Pb collisions at impact parameter b = 10.5 fm at $\sqrt{s_{NN}}$ = 2.76 TeV for different values of the ratio ε between the average spin flipping cross section to the average dissociation cross section of J/ψ in the CSM scenario (solid) compared with that in the COM scenario (dashed).

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