Hypertriton production in relativistic heavy ion collisions

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Using the coalescence model based on the phase-space distributions of kinetically freeze-out nucleons and Lambda hyperons from a blast-wave model, we have studied [1] in a coalescence model the production of hypertriton, which has a very small binding energy of about 130 keV [2] and large root-mean-square radius of about 4.9 fm [3], in relativistic heavy ion collisions. Including not only the coalescence process $p + n + \Lambda \rightarrow {}^{3}_{\Lambda}H$ but also the coalescence process $d + \Lambda \rightarrow {}^{3}_{\Lambda}H$ as the hypertriton can be considered as a loosely bound state of deuteron and Lambda, we have studied the dependence of the hypertriton yield on its freeze-out time by letting nucleons, Lambda hyperons, and deuterons to stream freely after they have frozen out from the initial fireball, and then carrying out the coalescence calculations for different free streaming times. We have found that the hypertriton yield, which reproduces the experimental data from central Pb+Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV at the LHC with the two coalescence processes giving similar contributions, decreases slowly with the free expansion of the fireball as shown in Fig. 1, especially for those produced from the $d + \Lambda$ coalescence. Our result thus indicates that the yield of hypertritons in relativistic heavy ion collisions is essentially determined when nucleons and Lambda hyperons freeze out kinetically, although they still undergo scattering with the freeze-out pions.

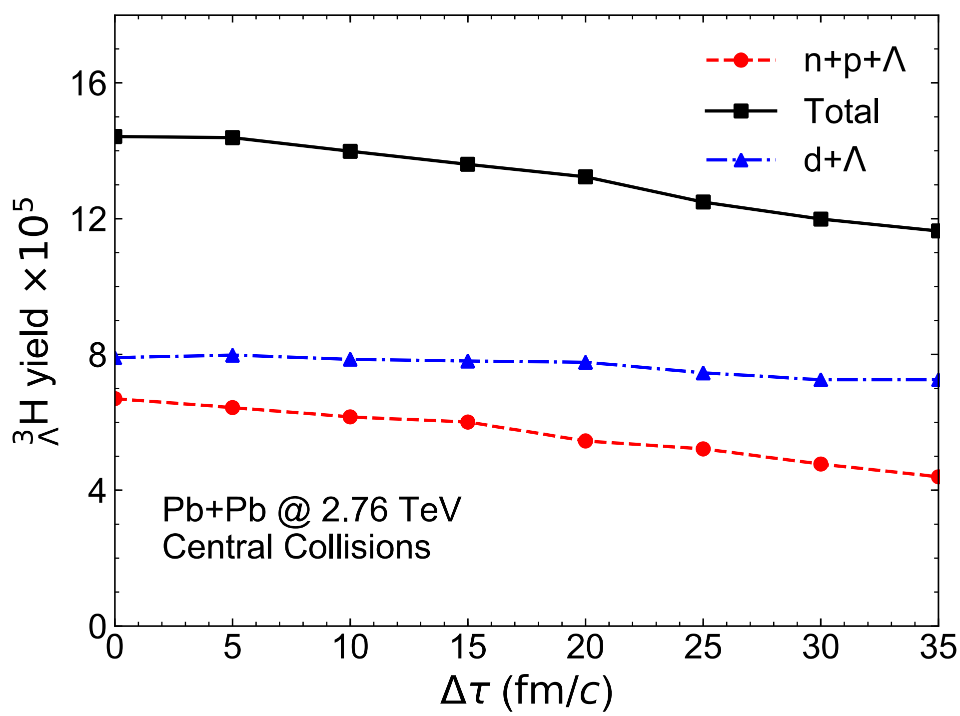

FIG. 1. Hypertriton yields from $\boldsymbol{n + p + \Lambda}$ and $\boldsymbol{d + \Lambda}$ coalescence together with the total yield as functions of the free streaming time $\boldsymbol{\Delta\tau}$.

[1] Z. Zhang and C.M. Ko, Phys. Lett. B **780**, 191 (2018).
[2] M. Juric, G. Bohm, J. Klabuhn, U. Krecker, F. Wysotzki, G. Coremans-Bertrand, J. Sacton, G. Wilquet, T. Cantwell, F. Esmael *et al.*, Nucl. Phys. **B52**, 1 (1973).
[3] H. Nemura, Y. Suzuki, Y. Fujiwara, and C. Nakamoto, Prog. Theor. Phys. **103**, 929 (2000).