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Production of charmed mesons, baryons and tetraquarks in heavy-ion collisions at the LHC

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We investigate the production of charmed hadrons ($\bar{D}$, Λ_c, Ξ_{cc}) and exotic tetraquarks (T_{cc}, T_{bc}) in relativistic heavy-ion collisions using the quark coalescence model. The yields are given by the overlap of the density matrix of the constituents in the emission source with the Wigner function of the produced meson, baryon and tetraquark. The wave functions are obtained from exact solutions of the two-, three- and four-body problem using a realistic constituent quark model. It contains a chromoelectric part made of a Coulomb-plus-linear interaction together with a chromomagnetic spin-spin term described by a regularized Breit-Fermi interaction with a smearing parameter that depends on the reduced mass of the interacting quarks. We take into account effects of temperature on the masses of the light quarks that enter in the quark model. The temperature dependence of those quantities are taken from the Nambu–Jona-Lasinio model. We found that the production yields of mesons, baryons and tetraquarks are typically one order of magnitude smaller than previous estimations based on simplified wave functions. We also evaluate the consequences of the partial restoration of chiral symmetry at the hadronization temperature on the coalescence probability. Such effects, in addition to increasing the stability of the tetraquarks, lead to an enhancement of the production yields.

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