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Charm meson and charm-meson molecule in an expanding hadron gas

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We study the time evolution of the number of charm mesons after the kinetic freeze-out of the hadron gas produced by a central heavy-ion collision. The $\pi D^* \to \pi D^*$ reaction rates have t-channel singularities that give contributions inversely proportional to the thermal width of the D. The ratio of the D^0 and D^+ production rate can differ significantly from those predicted using the measured D^* branching fractions.
We then study the thermal correction to the propagator of a loosely bound charm-meson molecule in a pion gas to next-to-leading order in the heavy-meson expansion. The correction comes primarily from the complex thermal energy shift of the charm-meson constituents. The remaining correction gives a tiny decrease in the binding energy of the molecule and a tiny change in its thermal width. These results are encouraging for the prospects of observing $X(3872)$ and $T_{cc}^+(3875)$ in the expanding hadron gas produced by heavy-ion collisions.

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