Formation Time in Relativistic Heavy Ion Collision

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Abstract

We study the role of formation time in the softening of hadronic matter. Experimentally, one finds larger temperature but smaller or similar radial flow at SPS energy compared with AGS energy. The key problem is whether it is required to assume QGP formation to explain this behavior. At these energies, increase of the hadronic degrees of freedom (DOF) can be another candidate to cause softening. Generally, particle spectra are expected to be softer in hadronic transport models with larger DOF. However, existing smaller DOF models also give similar transverse mass spectra to larger DOF models, and reproduce experimental data equally well. The reason of this has not been understood yet. We focus on the role of the formation time in the bulk property of the matter. When we compare the Mt spectra with and without formation time in heavy-ion collisions, we find the formation time reduces the higher Mt components and suppress the temperature of matter. The latter tendency also appears at equilibrium in transport model calculations with periodic boundary condition. These facts on dynamical and thermal properties show the formation time generate effective DOF, i.e. heavy-objects decaying to many-pions. We conclude the formation time enables the transport model with a few hadronic DOF to describe hadronic matter in relativistic heavy ion collision at AGS energies. The results suggest that a part of the softening of matter reaching to hagedron phase approximately is explained in hadronic scenario.

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