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Using local scaling of initial condition parameters to improve the system size dependence of transport model descriptions of nuclear collisions

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A multi-phase transport (AMPT) model has been successful in reproducing a wide range of observables in relativistic heavy-ion collisions. However, certain key parameters need to have significantly different values for pp and central AA collisions for the model to well describe the yield and transverse momentum spectrum of the bulk matter.

In this work[1], we extensively study the system size dependence of nuclear collisions with a multiphase transport model. We scale two key initial condition parameters, the Lund string fragmentation parameter bL and the minijet transverse momentum cutoff p0, with local nuclear thickness functions from the two colliding nuclei. This allows the model to use the parameter values for pp collisions with the local nuclear scaling to describe the system size and centrality dependences of nuclear collisions self-consistently. In addition to providing good descriptions of pp collisions from 23.6 GeV to 13 TeV and reasonable descriptions of the centrality dependence of charged particle yields for Au+Au collisions from 7.7A to 200A GeV and Pb+Pb collisions at LHC energies, the improved model can now for the first time well describe the centrality dependence of the mean transverse momentum of charged particles. It works similarly well for smaller systems including pPb, Cu+Cu and Xe+Xe collisions.
[1] C. Zhang, L. Zheng, S.S. Shi, Z-W. Lin, Phys. Rev. C 104 (2021) 014908

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