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Collectivity in small systems from a multi-phase transport model point of view

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The striking collectivity like behavior found in high-multiplicity proton-proton (pp) collisions and ultra-peripheral collisions (UPC) at the LHC challenges our conventional wisdom on the formation of the quark-gluon plasma (QGP). A microscopic explanation to the origin of collectivity in these collision systems at rather small scales will help us understand the mechanism that leads to the QGP-like signals in small systems. In our recent work, we have coupled PYTHIA8 initial conditions with sub-nucleon spatial fluctuations to the final state parton and hadron interactions and quark coalescence of the string melting AMPT model to study the small system collective effects. In this approach, the AMPT initial condition originally provided by HIJING is replaced by the PYTHIA/Angantyr model and includes the sub-nucleon structure for the struck nucleon and photon. We have found that the collective flow features in small collision systems can be well described by the AMPT model with sub-nucleon spatial fluctuation, indicating its importance for the small system evolution. In this talk, we will present these model results and comparisons to the experimental data.

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