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Multiplicity fluctuations and collective flow in small colliding systems

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Recent observation of collective-flow-like behaviors in small colliding systems
attracts significant theoretical and experimental interests.
In large colliding systems,
large collective flow has been interpreted as manifestation of almost-perfect
fluidity of the quark gluon plasma (QGP).
So it is quite intriguing to explore how small
the QGP can behave as a fluid.

In this presentation,
we newly develop an initialization model
for hydrodynamic simulations
by combining a
Monte-Carlo version of the Glauber model (MC-Glauber)
with an event generator PYTHIA.
We further implement this model into
an integrated dynamical framework [1]
which is based on
fully three-dimensional ideal hydrodynamic description
of the QGP fluid and kinetic description of the hadron gas.
Using this new version of integrated dynamical model,
we analyze multiplicity fluctuations and
collective flow in small colliding systems
at RHIC and LHC energies.

Multiplicity fluctuations play a crucial role in centrality definition of the events
in small colliding systems
since the fluctuations
are, in general, more important as the system size is getting smaller.
To consider the correct multiplicity fluctuations,
we employ
PYTHIA which
naturally describes multiplicity distribution in p+p collisions.
We superpose p+p collisions
by taking into account the number of participants and that of binary collisions
from MC-Glauber
and evaluate initial entropy density distributions which
contain not only multiplicity fluctuations but also fluctuations of longitudinal profiles.
Solving hydrodynamic equations followed by the hadronic afterburner,
we calculate p_T spectra, elliptic (v_2) and triangular (v_3) flow
in p+Au, d+Au and ^{3}He+Au collisions
at the RHIC energy and
p+Pb collisions at the LHC energy.
Although a large fraction of final p_T-integrated v_2 and v_3 comes from
the fluid-dynamical stage, the effects of hadronic rescatterings turn out to be also important as well
in understanding of the flow data in small colliding systems.

Reference

[1] T.Hirano, P.Huovinen, K.Murase and Y.Nara,
"Integrated Dynamical Approach to Relativistic Heavy Ion Collisions,"
Prog. Part. Nucl. Phys. **70**, 108 (2013)

Preferred Track

QCD in small systems

Collaboration

Not applicable

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