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Strangeness enhancement from dynamical core-corona initialisation model

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We investigate whether the quark gluon plasma (QGP) is created in small colliding systems focusing on hadron production mechanisms.

Recently the ALICE Collaboration reported strangeness enhancement in small colliding systems. The yield ratios of (multi-)strange hadrons to charged pions in various colliding systems show the monotonic increase and scaling with multiplicity [1]. Motivated by these ALICE data, we develop a unified and phenomenological description of the QGP formation based on the "dynamical initialisation model" [2].

In this work, we assume that all matters are generated from four-momentum deposition of initial partons. Here we extend the dynamical initialisation model [2] considering the core-corona picture [3]. We introduce four-momentum deposition rate from an initial traversing parton which depends on its transverse momentum and parton density surrounding it. We suppose the core region turns into QGP fluids due to the existence of high-density partons. While the rest part is supposed to be the corona region which cannot form QGP fluids due to few secondary parton interactions. QGP fluids as the core are particlised at hypersurface of fixed chemical freeze-out temperature, while partons as the corona are hadronized through string fragmentation processes. Thus yields of final hadrons is a sum of both contributions from the core and the corona in this model.

We show the (multi-)strangeness yield ratios monotonically increase with multiplicity and are reasonably consistent with the ALICE data. It follows that a key feature to explain this strangeness enhancement in small colliding systems is the continuous change of description from string fragmentation at small multiplicity to hadronisation from QGP fluids at intermediate to high multiplicities. This result strongly indicates that the QGP is partly formed in
high multiplicity small colliding systems.

[1] J.Adam *et al.*, [ALICE Collaboration], Nature Phys. **13**, 535 (2017).

[2] M.Okai, K.Kawaguchi, Y.Tachibana, T.Hirano, Phys.Rev.C **95**, no. 5, 054914 (2017).

[3] Y.Kanakubo, M.Okai, Y.Tachibana and T.Hirano, Progress of Theoretical and Experimental Physics **2018**, no.12, 121D01 (2018).

Collaboration name

Track

Strangeness and Light Flavour

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