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Transverse energy per charged particle at LHC: Is it a signature of non-equilibrium or gluon saturation?

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The pseudorapidity density of transverse energy per charged particle ($\frac{dE_T}{d\eta}/\frac{dN_{ch}}{d\eta} \equiv E_T/N_{ch}$) is an important
observable in high energy heavy-ion collisions, which reveals about the mechanism of particle production and the freeze-out criteria. Its collision energy and centrality dependence is exactly like the chemical freeze-out temperature till top RHIC energy and the LHC measurement at 2.76 TeV brings up a challenge to understand the same from the point of view of gluon saturation or non-equilibrium phenomena being prevalent at high energies. The statistical hadron gas model (SHGM) with a static fireball approximation has been successful in describing both the centrality and energy dependence till top RHIC energies. However, the SHGM predictions for higher energies are highly underestimated by the LHC data. In order to understand this, we have incorporated radial flow effect in an excluded volume SHGM. The hard-core radius of baryons at lower collision energies plays an important role in the description of a hadronic system. In view of this, in order to make a complete energy dependence study from FAIR to LHC energies, we have considered the excluded volume SHGM. Our studies suggest that the collective flow plays an important role in describing E_T/N_{ch} and it could be one of the possible parameters to explain the jump observed in E_T/N_{ch} from RHIC to LHC energies. We make a comparative study of gluon saturation picture with the finding of the discussed dynamical SHGM at high energies, in order to explain the above behaviour in experimental data. In contrast to the gluon saturation picture, the excluded volume SHGM gives a clear picture over a broad range of energies from few GeV to TeV.

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Fluctuation in initial conditions, collective flow and correlations

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