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Nonextensive statistics for analysing temperature fluctuations in heavy ion collisions.

We study temperature fluctuations in the initial stages of the relativistic heavy-ion collision using a multiphase transport model. We consider the plasma in the initial stages after the collision before it has a chance to equilibrate. We have considered Au + Au collision with a varying center of mass energy. We use the non-equilibrium Tsallis statistics to find the entropic index in the partonic stage of the relativistic heavy-ion collision. The Tsallis statistics is a generalization of the Boltzmann-Gibbs thermodynamic approach to non-equilibrium systems. The temperature fluctuations of an out of equilibrium system can be studied using the Tsallis statistics, provided the inverse of the temperature β can be fitted with a χ^2 distribution. The β obtained from our simulations is fitted with a χ^2 distribution and then used to obtain the entropic index (q). Previously, the entropic index was calculated by fitting the transverse momentum spectra of hadrons to the Tsallis distribution. We have shown that the entropic index can also be obtained for the partonic stage using temperature fluctuations. We see that the entropic index found from the temperature fluctuations for the partonic stage behaves similarly to the entropic index obtained from the final stage hadronic spectra. Similar to previous studies, we find that there is a linear dependency between the temperature T_{eff} and the entropic index q for the partonic system. However, the slope of the linearity depends on the kind of particles chosen to obtain the temperature of the system. A detailed analysis of the dependence of the entropic index on the system shows that for increasing space-time rapidity, the entropic index of the partonic system increases. The entropic index was also dependent on the beam collision energy. Thus, our current work indicates that a non-extensive formalism can be used in conjunction with a transport model to study the partonic stages of relativistic heavy-ion collisions.

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