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Fluctuations in produced charged particle multiplicities in relativistic nuclear collisions for simulated events

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Abstract. The event-by-event (E-by-E) fluctuations have been studied for relativistic heavy ion collisions and compared by theoretical prediction of available event generators. The multiplicity fluctuations are sensitive to QCD phase transition and to the presence of critical point in the QCD phase diagram. These fluctuations also provide baselines for other event-by-event (E-by-E) measurements. In the present article, a modest approach attempt has been made for a logical study of event-by-event (E-by-E) charge fluctuations in the relativistic nuclear collisions of proton-proton (p-p) and nucleus-nucleus (A-A) interactions. Finally, simulations by Monte Carlo Generators (MCGs) have been done and findings were found within good agreements with other works.

Introduction

The study of the early Universe in the standard big bang model necessarily requires also an intimate connection to particle physics. Already at a late time of the order of a minute, the nuclear and particle physics play an important role in determining the abundance of the light elements. It is commonly believed that ultrarelativistic nuclear collisions are possible test grounds of the formations of new phases of hadronic matter / quark gluon plasma (QGP) under extreme conditions [1-5].

Several prominent features have been already observed by various workers in the field of high energy physics, such as high multiplicity events large average transverse momentum, collective effects, the side-splash of the participants and the bounce-off of the spectator particles and the comparison with theoretical predictions and models. Early speculations of possible exotic states of matter focused on the astrophysical implications of abnormal states of dense nuclear matter.

A schematic representation of the phase diagram of strongly interacting matter, showing the transition between hadronic matter and the quark-gluon plasma as a function of temperature and baryon chemical potential has been depicted in Figure 1 [6,7]. The phase diagram of strongly interacting matter gives the following informations:

(i) At low temperatures and baryon densities, the system can be described in terms of hadrons, nucleons, mesons and internally excited states of nucleons.