Generalized statistics and the formation of a quark-gluon plasma

by

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Abstract

Substantial theoretical research has been carried out to study the phase transition between hadronic matter and a quark-gluon plasma (QGP). When calculating the QGP signatures in relativistic nuclear collisions, the distribution functions of quarks and gluons are traditionally described by Boltzmann-Gibbs (BG) statistics. Here we investigate the effect of both extensive and non-extensive forms of statistical mechanics on the formation of the QGP. We suggest to represent the dominant part of the *long-range* interactions among the constituents in the QGP by a change in the statistics of the system in this phase, and we study the relevance of this statistics for the phase transition. The results show that for small deviations ($\approx 10\%$) from BG statistics in the QGP phase, the critical temperature for the formation of a QGP does not change substantially for a large variation of the chemical potential. This can be interpreted as the formation of a QGP occurs at a critical temperature

which is almost independent of the total number of baryons participating in heavy ion collision. The resulting insensitivity of the critical temperature to the total number of baryons presents a clear experimental signature for the existence of fractal statistics for the constituents of the QGP.

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