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Speed of sound and systematic study of hadron spectra in Tsallis Statistics

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Tsallis non-extensive thermodynamics has been successfully used to describe the transverse momentum distributions from RHIC to LHC energies. Assuming the non-extensive parameter q∼1, Taylor expansion of Tsallis Boltzmann distribution function is performed up to first order in (q-1), which has an explicit radial flow dependence and an analytical result for the Tsallis distribution in the presence of collective flow is provided. The transverse momentum spectra at RHIC and LHC for A+A and p+p collisions are studied with this explicit radial flow dependent function along with Tsallis Boltzmann distribution function and Tsallis distribution including chemical potential. The information on the freeze-out surface in terms of freeze-out volume, temperature, chemical potential and radial flow velocities for different particle species are obtained. These parameters are studied as a function of particle mass and a differential freeze out scenario is observed. Also it is observed that the system formed in peripheral A+A and p+p collisions are of similar thermodynamic nature. Further, In the present work we extend the q-statistics for the physical resonance gas to examine the basic thermodynamical quantities for systems having different "q" parameters. The speed of sound is studies in the frame work of non-extensive statistics and the effect of q-parameter is observed on the mass cut-off behaviour.

Primary author: THAKUR, Dhananjaya (Indian Institute of Technology Indore (IN))

Co-authors: KHUNTIA, Arvind (Indian Institute of Technology Indore, India); CLEYMANS, Jean (Department of Physics); Ms PAREEK, Pooja (Indian Institute of Technology Indore (IN)); SAHOO, Pragati (Indian Institute of Technology Indore (IN)); Dr GARG, Prakhar (Indian Institute of Technology Indore (IN)); SAHOO, Raghunath (Indian Institute of Technology Indore (IN)); TRIPATHI, Sushanta (Indian Institute of Technology Indore, India); BHATTACHARYYA, Trambak (IIT Indore)

Presenter: THAKUR, Dhananjaya (Indian Institute of Technology Indore (IN))

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