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Production of Strange, Non-Strange Particles and Hypernuclei in an Excluded-Volume Model

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Recently, we proposed a thermodynamically consistent excluded-volume model for a hot, dense hadron gas (HG). We confront our model calculations on various properties of HG, multiplicity and ratios of various strange and non-strange particles in the entire range of temperature and baryon densities with the other models and experimental data and we find that our model describes the experimental data suitably in comparison to other models. Furthermore, we numerically show that our model respects causality while most of the excluded-volume models suffer from this deficiency. Our model describes the production of strange particles satisfactorily but fails in describing multistrange particles (i. e. \phi, \Omega etc.) production. So, we need another kind of mechanism to describe the production of multistrange particles successfully. We test our model in getting the rapidity as well as transverse mass spectra of various strange and non-strange hadrons. We find that our model with the effect of flow describes the experimental data on transverse mass spectra and rapidity distributions very well. Further, we analyze the production of light nuclei, hypernuclei and their anti-nuclei over a broad energy range from Alternating Gradient Synchrotron (AGS) to Large Hadron Collider (LHC) energies using our excluded-volume model. We again find a good agreement between our model calculations and experimental data. Thus, we conclude that our excluded-volume model is a proper equation of state (EOS) for hot and dense HG.

Summary

Our analysis shows that, our excluded-volume model is capable of describing almost all the features of hot and dense hadron gas (HG) and hence it is a proper equation of state for hot, dense HG. Although, our model is an approximate thermodynamically consistent because we use Neumann iteration series to calculate no. density of baryons in which we take only few order of terms.

Author: TIWARI, Swatantra Kumar (Banaras Hindu University)

Co-author: Prof. SINGH, C. P. (Banaras Hindu University)

Presenter: TIWARI, Swatantra Kumar (Banaras Hindu University)

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