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Study of Relative Particle Yields in a Hot and Dense Gas of Interacting Hadrons in a Thermal Model Approach

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We have provided a modified grand canonical ensemble formulation for a multi-component hadron resonance gas system. We have considered the attractive as well as repulsive interaction among the constituent baryons (antibaryons) and obtained a Van der Waals type equation of state. The weak decay contributions of the heavier resonances have also been taken into account. Using our formulation we have calculated several relative hadronic yields as well as nucleon (antinucleon) densities in the system in a thermodynamically consistent manner. It is found that the particle ratios get significantly modified in the case of Van der Waals interactions for a baryon rich system and at high temperatures. We find that by employing the Van der Waals type equation of state, we can reasonably predict several particle ratios obtained in the CERN SPS at 80A and 40A GeV within a temperature range of 155-165 MeV for baryon chemical potentials 300 MeV and 500 MeV, respectively for the two cases. In this approach the repulsive force is assumed to exist between pairs of two baryons and pairs of two antibaryons, while it is purely attractive between a baryon-antibaryon pair. The values of attractive and repulsive parameters have been obtained from the earlier studies which are required to reproduce the ground state properties of nuclear matter. We have also studied the effect of the variation of these parameters on our results.

Session

Heavy Ions and QCD

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