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Analysis of hadron yield data within hadron resonance gas model with multi-component eigenvolume corrections

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The hadron-resonance gas (HRG) model with
the hadron type dependent eigenvolume (EV) corrections is employed to fit the hadron
yield data of the ALICE and the NA49 collaborations.
The influence of the EV corrections is studied within two different formulations of the eigenvolume HRG model.
For the case of the point-particle HRG the extracted values of temperature and chemical potential are consistent with previous findings.
However, the situation changes if hadrons have different eigenvolumes.
These results show that the extraction of the chemical freeze-out parameters is
extremely sensitive to the modeling of the short-range repulsion between the hadrons,
and imply that the point-particle HRG cannot be used for a reliable determination of the chemical freeze-out conditions.
For instance, when we
apply the eigenvolume corrections with the mass-proportional eigenvolume $v_i \sim m_i$, fixed to different values of the proton hard-core radius r_p, we obtain
a noticeably better description of the data at all the considered collision energies in very wide high-T, high-μ_B regions within both EV models. Similar picture emerges in the case when all mesons are modeled as point-like while all baryons have a fixed hard-core radius. The entropy per baryon, on the other hand, shows a much weaker model dependency.

The HRG model is also compared to the lattice data. It is found that moderate eigenvolume corrections lead to a better agreement with the lattice data at higher temperatures. Additionally, the role of the Hagedorn mass spectrum is explored.

On behalf of collaboration:

None

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