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Production of Light Nuclei in Heavy-Ion Collisions using Hadron Resonance Gas Model

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The study of light nuclei production in relativistic heavy-ion collisions provides valuable insights into the properties of the dense, hot medium produced in these collisions, which is assumed to mimic conditions of the early universe. In this work, we analyze the production of light (anti-)nuclei, such as d, $\bar{d}$, t, and ^{3}He, in the framework of the Hadron Resonance Gas (HRG) model – a theoretical approach that treats the hadronic phase as a gas composed of hadrons and their resonances. Following the approach of applying the nuclear equivalent of the Saha equation, we explore the evolution of light nuclei abundances post-chemical freeze-out, where disintegration and regeneration reactions are assumed to proceed in relative chemical equilibrium within the hadronic phase. Using the HRG model in Partial Chemical Equilibrium (PCE) available in the Thermal-FIST package, we study the sensitivity of light nuclei yields to temperature at the RHIC energies. The resulting predictions are compared with experimental data from the STAR Collaboration, offering a comprehensive understanding of the thermal properties and reaction kinetics in the expanding fireball.

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