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Modeling thermodynamics of compressed baryonic matter

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In this work, we investigate the thermodynamics of light hadronic matter in a two-flavour system using the Hadron resonance gas (HRG), Nambu–Jona-Lasinio (NJL), and Chiral models. The study is relevant for exploring the quantum chromodynamics (QCD) phase structure at low energies, particularly in the context of the FAIR-CBM and NICA experiments. Key observables such as pressure, entropy, energy density, and number density are analysed across temperature and baryon density regimes and compared with the Stefan–Boltzmann (SB) limit. The HRG model is reliable only below Tc, while the NJL and Chiral models capture chiral restoration and gradually saturate toward the SB limit. This comparative study provides important insights into QCD matter under extreme conditions.

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