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Van der Waals equation of state: from nuclear matter to lattice QCD

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An extension of the ideal hadron resonance gas (HRG) model is constructed which includes the attractive and repulsive van der Waals (VDW) interactions between baryons. This VDW-HRG model yields the nuclear liquid-gas transition at low temperatures and high baryon densities. The VDW parameters a and b are fixed by the ground state properties of nuclear matter.
The temperature dependence of various thermodynamic observables at zero chemical potential are calculated within VDW-HRG model. Compared to the ideal HRG, the inclusion of VDW interactions between baryons leads to a qualitatively different behavior of 2nd and higher moments of fluctuations of conserved charges, in particular in the so-called crossover region T=140-190 MeV. For many observables this behavior
resembles closely the results obtained from lattice QCD simulations.

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