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Temperature Dependent Hadronic Bag and QGP Phase Transition in Dual QCD

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Based on the magnetic symmetry structure of non-Abelian gauge theories, a dual QCD gauge theory is constructed which takes into account the local structure as well as the topological structure of the color gauge group into its dynamics and contains two potentials, the electric and the magnetic potentials in a dual-symmetric way. Using the dual version of QCD in thermal domain following the partition function approach and the grand canonical ensemble formulation, the phase transition from hadron to QGP phase has been investigated within the framework of temperature dependent hadronic bag in the entire T-μ plane. The various thermodynamic properties including pressure, energy density, entropy density, speed of sound and specific heat of the hadron/QGP phase have been investigated and shown to give the firm evidence of the first order phase transition. The profile of the pressure has been shown to be continuous function of the temperature across the phase transition and energy densities have finite jump discontinuities at critical temperature with latent heat. For zero chemical potential it has been shown that the first-order QGP phase transition turns into a rapid crossover. All the independent thermodynamic quantities are exponentially suppressed below the critical temperature and rather slowly approach their Stefan-Boltzmann limits at high temperatures. The interfacial surface tension has also been calculated and found to be proportional to the cube of transition temperature. These predictions are in remarkable agreement with lattice and MIT bag model results.

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