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QCD thermodynamics at intermediate coupling

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The weak-coupling expansion of the QCD free energy is known to order gˆ6*log[g], however, the resulting series is poorly convergent at phenomenologically relevant temperatures. I will discuss how the gauge invariant hard-thermal-loop perturbation theory (HTLpt) reorganization of the calculation improves the convergence of the successive approximations to the QCD free energy. I will present new results of an HTLpt calculation of QCD thermodynamics to three loops. The results of this calculation are consistent with lattice data down to 2-3T_c. This is a non-trivial result since, in this temperature regime, the QCD coupling constant is neither infinitesimally weak nor infinitely strong with g˜2, or equivalently alpha_s˜0.3. Therefore, we have a crucial test of the quasiparticle picture in the intermediate coupling regime. Our results suggest that HTLpt provides a systematic framework that can be used to calculate static and dynamic quantities for temperatures relevant at LHC.

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