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Matrix Models for Deconfinement and Their Perturbative Corrections

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Matrix models for the deconfining phase transition in SU(N) gauge theories have been developed in recent years. With a few parameters, these models are able to reproduce the lattice results of the thermodynamic quantities in the semi-quark gluon plasma(QGP) region. They are also used to compute the behavior of the 't Hooft loop and study the exceptional group G(2) . In this talk, I review the basic ideas of the construction of these models and propose a new form of the non-ideal corrections in the matrix model. In the semi-QGP region, the new model is in good agreement with the lattice simulations as the previous ones, while in higher temperature region, it reproduces the upward trend of the rescaled trace anomaly as found in lattice which, however, can not be obtained from the previous models. In addition, I discuss the perturbative corrections to the thermal effective potential which could be used to systematically improve the matrix models at high temperatures. In particular, I provide, for the first time, an analytical proof of the relation between the one- and two-loop effective potential: two-loop correction is proportional to the one-loop result, independent of the eigenvalues of the Polyakov loop. This is a very general result, I prove it for all classic groups, including SU(N) , SO(2N+1) , SO(2N) and Sp(2N) .

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