The chemical potential of D-instantons in $c < 1$ Noncritical string theory

High Energy Accelerator Research Organization (KEK) Atsushi Yamaguchi
E-mail: ayamagu@post.kek.jp

The nonperturbative effects in string theory reveal one of the most stringy features of string theory. From the large-order behavior in perturbation series, or the calculation of the D-instanton effects, one can see that the nonperturbative effects are of the form $\exp(-S_0/g_{\mathrm{s}})$, where g_{s} is the string coupling constant. Studying such effects is important because we may be able to get some clues about the nonperturbative formulation of string theory by doing so. Noncritical string theory is a useful toy model for such an investigation. It possesses much fewer degrees of freedom compared with the critical one, and it can be nonperturbatively defined via a matrix model.

Nonperturbative effects in noncritical string theory have been much studied. Especially, the value of S_0 is derived from the string equation, or as the action of solitonic excitations. More recently, nonperturbative effects in the $c = 0$ noncritical string theory are analyzed concretely using the one-matrix model [1]. In [1], the next to leading order contributions to the non-perturbative effects, which can be identified with the chemical potential of D-instantons, were computed by the method of orthogonal polynomials. It was shown that the nonperturbative effects up to this order are universal in the sense that these were independent of details of the matrix model potential.

In [2], we ask whether the results in [1] can be generalized to $c < 1$ noncritical string theory. Since $c < 1$ noncritical string theory is defined in a nonperturbative manner by taking an appropriate double scaling limit of the two-matrix model, it is necessary to examine nonperturbative effects by using the two-matrix model. For this purpose, we define the effective potential of the matrix eigenvalues as in [1]. The nonperturbative effects are due to stationary points of this effective potential. In [3], the leading order contributions to the nonperturbative effects are obtained from the effective potential for the two-matrix model and are shown to coincide with the results in the continuum approach. What we would like to do is to calculate the next to leading order contribution. In order to do this, we generalize the method proposed recently in [4] to the two-matrix model case. We further prove that the result is universal in the double scaling limit as in the $c = 0$ case.

References

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