Supersymmetry, Spectrum and Fate of D0-Dp Systems with B-field[1]

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Recently there has been a renewed interest in D0-Dp or more generally Dp-Dp' systems.

One of the motivations for this study arises from its close relation to Dp-$\overline{\mathrm{D}p}$ systems, which contain tachyons. Examination of the fate of the D0-Dp systems may help us understand the properties of tachyons in the closed string.

Another motivation is to examine various properties of noncommutative theories. It is now well known that such field theories can be obtained from the field theories with background B-field in a certain limit [1]. A lot of nonperturbative behaviors of field theories have been learned from their realization on the branes. Conversely, it turns out that noncommutative theories have very interesting realization of soliton solutions [2, 3], and this allows us to examine various properties of branes realized as solitons in such theories.

In this talk I have discussed the following topics:

(1) the BPS conditions of D0-Dp systems for even p with background B-field [4] in type IIA string theories. The background field is easily related to rotation angles between branes [5] and then earlier results for such systems can be simply adopted [6]. More importantly we have discussed supersymmetry enhancement for D0-D8 system;

(2) the stability of the systems by computing the lowest energy in the string picture;

(3) the soliton realization of D0-Dp system in noncommutative theories. In particular, solution generating techniques are briefly summarized to generate D0-Dp, and examine stability conditions by computing the complete mass spectrum around the soliton solution. We have obtained results completely consistent with the string picture in **(2)**, and spectrum consistent with supersymmetry summarized in **(1)**.

(4) the effective potential for scalar modes in the system. We have found that there are several stationary points which correspond to brane systems with expanded flux.

[1]Dedicated to the memory of my colleague and friend, Sung-Kil Yang.

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I have concluded with several future directions.

(a) more complete computation of the effective potential for scalar modes. This allows to see the phase structure of the system and to understand ultimate fate of the D0-Dp systems.

(b) the scattering process involving these states.

Both of these problems are currently under study and will be reported elsewhere.

Acknowledgements

The work described here is based on [7]. I am grateful to the coauthors for collaboration. I would also like to thank the audience, in particular R. Gopakumar and S.-J. Rey, for useful discussions, the audience for raising interesting questions, and the organizers for preparing such a relaxed good workshop.

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