CFT for Closed String Tachyon Condensation

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In this talk, I discussed classical solutions of a graviton-dilaton-tachyon-$B_{\mu\nu}$ system which could be regarded as a simplified version of the low energy effective theory of a string theory with a tachyon in its mass spectrum, in spite of the title.

The action to be considered is

$$S=\frac{1}{2\kappa^2}\int d^Dx\sqrt{-g}\,e^{-2\Phi}\Big[R+4(\nabla\Phi)^2-\frac{1}{12}H^2-(\nabla T)^2-V(T)\Big]. \tag{1}$$

This could be regarded as an effective theory of, for example, a bosonic string theory compactified on a $(26-D)$-dimensional compact manifold M. Suppose that $V(T)$ has a maximum at $T=0$ and a minimum at $T=T_{\rm min}$.

There are classical solutions with a constant tachyon T. The one is a linear dilaton solution with $B_{\mu\nu}=0$ and $T=0,T_{\rm min}$. The other is an AdS_3 solution with a non-trivial H-flux, provided $V(T)<0$. Note that the latter solution has a constant dilaton profile, so the perturbative analysis around this solution is reliable.

There are also classical solutions in which T varies along a spatial direction. I concentrate on a three-dimensional subspace along which the H-flux may be non-trivial. The following ansatz

$$\begin{aligned} ds^2 &= -e^{-2A(x)}dt^2+dx^2+e^{-2B(x)}dy^2, && (2)\\ H^{012} &= e^{A(x)+B(x)}h(x), && (3)\end{aligned}$$

are made, and Φ and T are assumed to be functions of x.

The relevant equations of motion are

$$T''-KT'-V'(T)=0,\qquad K'-K^2-2V(T)=0\quad, \tag{4}$$

$$\Phi''-K\Phi'-V(T)-\tfrac{1}{2}e^{4\Phi}=0\quad, \tag{5}$$

where K was originally $K=A'+B'+2\Phi'$. It can be checked that there is a solution which interpolates $T=0$ and $T=T_{\rm min}$. Then the third equation (5) shows that a solution which is AdS_3 at $T=0$ and is a linear dilaton at $T=T_{\rm min}$ is *absent*, although the other kinds of interpolating solutions exist. This seems to suggest that AdS_3 solution would be more likely to be realized as an endpoint of a tachyon condensation, than a linear dilaton solution.

In addition, I discussed a stability issue of the AdS_3 solutions. When the compact manifold M is described by a product of minimal models, there is always a state which is below the Breitenlohner-Freedman bound, that is, such a solution cannot be stable even perturbatively. However, there are choices of M in which all states except for the bulk tachyon are stabilized by the AdS_3 background. The details are contained in hep-th/0610127.