Stability of Fuzzy CP^2 in IIB Matrix Model.

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IIB matrix model is a candidate of a non-perturbative formulation of string theory, and we can observe the spacetime dimension dynamically with investigating the effective action. Up to now, it has been found that 4 dimensional spacetime tends to minimize the effective action. Therefore, to examine the background's dynamics in IIB matrix model may be of help to explain 4 dimensional spacetime in string theory.

In previous work, we have found that the fuzzy $S^2 \times S^2$ background is not stable at most symmetric point(Two fuzzy spheres is equal.). We also have found more symmetric manifolds is stable. Therefore CP^2 which is a more symmetric manifold is interesting and will be stable. It is also interesting that the effective action of CP^2 is compared with $S^2 \times S^2$'s one.

IIB matrix model is

$$S_{IIB} = -\frac{1}{4} Tr \left[A_\mu, A_\nu\right]^2 - \frac{1}{2} Tr \bar{\psi} \Gamma_\mu \left[A_\mu, \psi\right], \tag{1}$$

where A_μ and ψ are $N \times N$ Hermitian matrices. We can separate A_μ and ψ into background fields and quantum fluctuations. Embedding fuzzy CP^2, we take the bosonic background fields as $SU(3)$ algebra. The irreducible representations of $SU(3)$ can be classified by the Young Tableaux $(p,q) \equiv \begin{array}{|c|c|c|c|c|}\hline 1 & \cdots & q & \cdots & q{+}p \\ \hline & & & \multicolumn{2}{c}{} \\ \cline{1-3}\end{array}$. When the representation is $(p,0)$, the background becomes fuzzy CP^2. In (p,p) rep., it becomes 6 dim. geometry. In (p,q) where $p \neq q$ and q is fixed, we can find that the background acts like the $U(q+1)$ gauge theory of the fuzzy CP^2. Then we have to observe the effective action which is on the fuzzy CP^2 and the related manifolds.

We calculate the effective action up to 2-loop level and observe the minimum of it. The results are

· Fuzzy CP^2 is a solution of IIB matrix model up to 2-loop level.
· Fuzzy CP^2 is stable as far as $SU(3)$ symmetry is not broken.
· The minimum of the effective action of CP^2 is comparable to $S^2 \times S^2$ one.
· The 4 dim. manifold is preferable to the 6 dim. one. This is the same as the fuzzy spheres case.
· The scaling behavior of the effective action on the fuzzy CP^2 is $O(N)$. This is the same as the fuzzy $S^2 \times S^2$ and T^4 cases.

Note:See hep-th/0506033, the references of my talk are found.