ADHM is a Tachyon Condensation

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We completely realize the ADHM construction of instantons in D-brane language of tachyon condensations. Every step of the construction is given a physical interpretation in string theory, in a boundary state formalism valid all order in α'. Accordingly, equivalence between Yang-Mills configurations on D4-branes and D0-branes inside the D4-branes is proven, which shows that small instanton configurations of the Yang-Mills fields are protected against stringy α' corrections. We provide also D-brane realizations of the inverse ADHM construction, the completeness, and the noncommutative ADHM construction. This presentation is based on a collaboration with Seiji Terashima, and e-print number in the archive is hep-th/0511297 [1].

The mystery of the physical meaning of the ADHM construction consists of the following three, which we are going to provide an answer. (i)What is the physical meaning of the Dirac operator? (ii) Why we need to solve the Dirac zero mode equation? (iii) Why from the Dirac zero modes we can obtain the self-dual gauge field strength via a pure-gauge-like formula? The first question has been asked before and in fact Akhmedov et.al suggested that the Dirac operator is a tachyon profile in DDbar system in string theory. The ADHM data is coming from a D0-D4 strings and D0-D0 strings, and these excitations are encoded in the tachyon field of the D4D4bar system a la K-theory. We make this statement precise, by showing that the tachyon profile is α'-exact on the boundary state of D4-branes and anti D4-branes. Then the answer to the second question is naturally obtained: the Dirac zero modes are wave functions of the D4-branes which remains after the tachyon condensation. Then, the gauge field configuration on the remaining D4-branes is given by a part of the pure gauge, since we are looking only at the branes which survives the tachyon condensation. This answers the third question.

One can apply the same technique to the case of monopoles [2] and its construction found by Nahm. In this case, crucial is the introduction of infinite number of brane-antibranes from which arbitrary D-brane can be constructed, exhibiting a unified view of various D-branes. We explicitly show the equivalence of the D3-brane boundary state with the monopole profile and the D1-brane boundary state with the Nahm data as transverse scalars.

References:

[1] *"ADHM is Tachyon Condensation,"* Seiji Terashima and K.H., *JHEP* **0602** (2006) 018, hep-th/0511297.

[2] *"Stringy Derivation of Nahm Construction of Monopoles,"* Seiji Terashima and K.H., *JHEP* **0509** (2005) 055, hep-th/0507078.