Phase structure of the large-N reduced gauge theory and generalized Weingarten model

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We studied a generalization of Weingarten model reduced to a point [1][1], whose action is given by

$$S = -\beta N \sum_{\mu \neq \nu}^{d} Tr \left(A_\mu^\dagger A_\nu^\dagger A_\mu A_\nu \right) + \kappa N \sum_{\mu=1}^{d} Tr \left(A_\mu^\dagger A_\mu - 1 \right)^2 .$$

This model interpolates the Weingarten's lattice string theory [2] ($\kappa \to 0$) and the large-N reduced $U(N)$ gauge theory [3] ($\kappa \to \infty$).

We found that the $U(1)^d$ symmetry is broken one by one, and restored simultaneously as $U(1)^d \to U(1)^{d-1} \to \cdots \to U(1) \to 1 \to U(1)^d$ as we change the coupling constants. We also found the Gross-Witten type third order phase transitions.

In order to determine whether the continuum limit exists, we calculated the expectation value of the Wilson loop by Monte-Carlo simulation. We found that for $d = 2$ the string tension becomes zero at the phase transion where $U(1)^2$ symmetry breaks down. Therefore, we may take a continuum limit at this point. In order for smooth surface to dominate the path-integral, the string suceptibility must be smaller than -2. Whether this is the case or not is now under investigation.

This poster session was based on the paper [1] and a work in progress with F. Kubo.

References

[1] M. Hanada, H. Kawai, T. Kanai and F. Kubo, Prog. Theor. Phys. **115** (2006) 1167, hep-th/0604065.

[2] D. Weingarten, Phys. Lett. B90 (1980) 280.

[3] T. Eguchi and H. Kawai, Phys. Rev. Lett. 48 (1982) 1063.

[4] E-M. Ilgenfritz, Y.M. Makeenko and T.V. Shakhbazian, Phys. Lett. B172 (1986) 81.

[1] Similar model on lattice was proposed in [4].