

## **Two-dimensional lattice for four-dimensional supersymmetric Yang-Mills**

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In this talk, I will discuss on a lattice formulation for supersymmetric Yang-Mills (SYM) theories with extended supersymmetry, which preserves a part of the supersymmetry on lattice. For cases of two dimensions, we can see that lattice models in such a formulation lead to the target continuum theories with no fine-tuning. Namely, supersymmetries or some other symmetries not realized on the lattice are automatically restored in the continuum limit. Next, we consider a mass deformation to  $N=(8,8)$  SYM and present its lattice formulation with keeping two supersymmetries. It provides a nonperturbative framework to investigate IIA matrix string theory. Moreover, since it has fuzzy sphere solutions around which four-dimensional theory is deconstructed, it will serve a nonperturbative formulation of four-dimensional  $N=4$  SYM which requires no fine-tuning. The rank of the gauge group is not restricted to large  $N$ . It opens a quite interesting possibility to test a AdS/CFT correspondence in a stringy regime where the effects from string loops cannot be neglected. Also, for two-dimensional  $N=(4,4)$  SYM, a similar argument is possible to obtain four-dimensional  $N=2$  SYM on noncommutative space.