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Topological gravity on the lattice

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I show that a particular twist of N=4 super Yang-Mills in three dimensions with gauge group SU(2) possesses a set of classical vacua corresponding to the space of flat connections of the complexified gauge group SL(2,C). The theory also containsa set of topological observables corresponding to Wilson loops wrapping non-trivial cycles of the base manifold. This moduli space
and set of topological observables is shared with the Chern Simons formulation of three dimensional gravity and we hence conjecture that the Yang-Mills theory gives an equivalent description of the gravitational theory. Unlike the Chern Simons formulation the twisted Yang-Mills theory possesses a supersymmetric and gauge invariant lattice construction which then provides a possible non-perturbative definition of three dimensional gravity.

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