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Definition of Instantons in Noncommutative Gauge Theory in Higher Dimensions

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Theories with noncommutative space-time coordinates represent alternative candidates of grand unified theories. We discuss $U(1)$ gauge theory in 2 and 4 dimensions on a lattice with N sites. The mapping to a $U(N)$ plaquette model in the sense of Eguchi and Kawai can be used for computer simulations. In 2D it turns out that the formulation of the topological charge leads to the imaginary part of the plaquette. Concerning 4D, the definition of instantons seems straightforward. One can transcribe the plaquette and hypercube formulation to the matrix theory. The transcription of a monopole observable seems to be difficult. The analogy to commutative $U(1)$ theory of summing up the phases over an elementary cube does not obviously transfer to the $U(N)$ theory in the matrix model. It would be interesting to measure the topological charge on a noncommutative hypercube.

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Poster

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