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Two Dimensional Lattice Gauge Theory Based on a Quantum Group

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Abstract: In this article we analyse a two dimensional lattice gauge theory based on a quantum group. The algebra generated by gauge fields is the lattice algebra introduced recently by A.Yu. Alekseev, H. Grosse and V. Schomerus in [1]. We define and study Wilson loops. This theory is quasi-topological as in the classical case, which allows us to compute the correlation functions of this theory on an arbitrary surface.

1. Introduction

Quantum groups appeared in the mid-eighties as hidden algebraic structures generalizing the notion of group symmetries in integrable systems [11]. There are now different definitions of quantum groups which include the local point of view (deformation of the Lie algebra) as well as the global point of view (deformation of the algebra of continuous functions on a Lie group).

The latter provides examples of quantum geometry, and the ordinary tools of differential geometry on Lie groups can be successfully defined and used to study, for example, harmonic analysis on quantum groups [19]. This success has encouraged people to apply these tools to build examples of quantum geometry where the notion of group symmetry is essential: quantum vector spaces, quantum homogeneous spaces, quantum principal fiber bundles [5]. It is then tempting to hope that quantum groups can be used in a much broader area than just integrable models, and could give, as an example, a Yang Mills type theory associated to a quantum group, leading hopefully to new Physics. There has been quite a lot of work dealing with q-deformed Yang Mills theory with a base space being a classical space or a quantum space. These works only deal with the study of what could be called classical configurations of the gauge fields, but do not study the path integral on the space of connections. The work of [5] although perfectly coherent for

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