CONSTRUCTION AND PROPERTIES OF NONCOMMUTATIVE QUANTUM FIELDS

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Local quantum field theory models in 4 space-time dimensions suffer from ultraviolet singularities and divergences of subsequences of the pertubation expansion, which leads to the triviality of the scalar field theory and to the Landau ghost problem. In order to get an improvement it was suggested to add "gravity" effects, respectively to deform space-time.
The resulting models, in general, suffer from the Infrared Ultraviolet mixing. For Euclidean deformed space-time this can be cured and leads to a special model, which needs 4 (instead of 3) relevant/marginal operators in the defining Lagrangian. This model is renormalizable up to all orders in pertubation theory. In addition a new fixed point appears. The beta function vanishes at the fixed point to all orders in pertubation theory. This way, we were able to tame the Landau ghost. The renormalization group flow is bounded.
We discuss Ward identities and Schwinger-Dyson equations. We derive integral equations for the renormalized N-point functions. They are the starting point of a nonperturbative construction.
We describe the deformation procedure for models defined over Minkowski space-time too and discuss properties of the resulting models. Especially locality turns into wedge locality.
Finally we remark on a relation between Minkowski and Euclidean deformed models for degenerate deformations.

Keywords: Noncommutative Quantum Fields, Landau ghost, Renormalization, Ward identities, Schwinger-Dyson equations, Wedge locality

[1] CMP 256:305-374,2005, arXiv:0909.1389

[2] JHEP 0711:012,2007, CMP304:95-123,2011, arXiv:1111.6856