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Non-commutative fields in semiclassical gravity: anomalous diffusion and deformed Fock space

Thursday, 21 June 2012 15:00 (30 minutes)

Relativistic particles with momentum space described by a group manifold provide a very interesting link between gravity, quantum group symmetries and non-commutative field theories. I will discuss how group valued momenta emerge in the context of three dimensional Einstein gravity and describe the related non-commutative field theory. As an application I will introduce a non-commutative heat-kernel, calculate the associated spectral dimension and comment on its non-trivial behaviour. In four space-time dimensions the only known example of momenta living on a group manifold is encountered in the context of the k-Poincare' algebra which bears many structural analogies with the algebra of deformed symmetries encountered in the three dimensional case. I will discuss the construction of a one-particle Hilbert space from the classical k-deformed phase space and show how the group manifold structure of momentum space leads to an ambiguity in the quantization procedure. At the multiparticle level I will show how the quantum group symmetry of the Hilbert space induces additional structure which reflects in a non-trivial, momentum-dependent statistics. The richer structure of the deformed Fock space allows for the possibility of entanglement between the field modes and "planckian" degrees of freedom.

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