Abstract of the Dissertation:

"Some operator algebraic techniques in Loop Quantum Gravity"

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The aim of the work is to give a mathematial description for a theory of Quantum Gravity. The following objects will be studied

- the two known algebras of Quantum Gravity in the Loop Quantum Gravity approach, which are
  the holonomy-flux *-algebra (given in [2]) and the Weyl C^*-algebra (given in [1]),
- modifications of these algebras and new algebras of Loop Quantum Gravity,
- states and representations of the algebras and
- the concept of quantum constraints and KMS-Theory in Loop Quantum Gravity.

In comparison to other theories of quantum physics it is obtained that, the two known algebras are not the only algebras in the Loop Quantum Gravity framework. Surprisingly, a huge amount of different algebras in Loop Quantum Gravity will be presented in the project. The idea of the construction of these algebras is to establish a finite set of operators, which generate (in the sense of Woronowicz, Schmüdgen and Inoue) the different O^*- or C^*-algebras of quantum gravity. In the Loop Quantum Gravity approach usually the basic classical variables are connections and electric fluxes. Studying the three constraints appearing in the canonical quantisation of classical general relativity in the ADM-formalism some other variables like curvature appear. Consequently, the main difficulty of the quantisation of gravity is to find a suitable replacement of the set of elementary classical variables and constraints. The important aim of this project is to modify the holonomy-flux *-algebra and the Weyl C^*-algebra in such a way that the set of constraints of Quantum Gravity in the formulation of the Ashtekar variables is a sub-algebra of the modified O^*- or C^*-algebra, which is generated by a set of the operators associated to holonomies, fluxes, diffeomorphisms and in some cases even the curvature. In this dissertation an exceptional algebra satisfying this property, will be proposed.