GR 4 Quantengravitation – Loops

Zeit: Freitag 14:00–16:00 Raum: TU BH262

GR 4.1 Fr 14:00 TU BH262

Spherically Symmetric Quantum Geometry — •Martin Bojowald — Max-Planck-Institut für Gravitationsphysik, Albert-Einstein-Institut, Am Mühlenberg 1, 14476 Potsdam

Loop Quantum Gravity provides a framework for quantum geometry which can be probed by studying symmetric configurations in the theory. Properties of quantum black holes can be understood by employing spherical symmetry which will be reviewed here. This leads to non-trivial tests of the full theory, as well as several physical applications to be discussed in more detail in the talk by Rafal Swiderski.

GR 4.2 Fr 14:15 TU BH262

Spherically Symmetric Quantum Geometry II — •Rafal Swiderski and Martin Bojowald — Max-Planck-Institut für Gravitationsphysik, Albert-Einstein-Institut, Am Mühlenberg 1, 14476 Golm

One of the open questions in the loop approach to the quantization of General Relativity is whether the theory has the correct classical limit. We investigate this issue in the context of spherically symmetrically reduced Loop Quantum Gravity. In addition, we discuss some applications of our symmetry reduced model to isolated horizons.

GR 4.3 Fr 14:30 TU BH262

Quantum Dynamics of Loop Quantum Gravity — •Thomas Thiemann — AEI and PI

We report on the current status of the quantum dynamics of Loop Quantum Gravity.

GR 4.4 Fr 14:45 TU BH262

An alternative Quantisation of the Flux Operator in Loop Quantum Gravity — •Kristina Giesel[1,2] and Thomas Thiemann[1,2] — [1]Albert-Einstein Institut für Gravitationsphysik, Am Mühlenberg 1, 14476 Golm — [2]Perimeter Institute for Theoretical Physics, 31 Caroline Street, Waterloo, Ontario N2L 2Y5, Canada

We will introduce an alternative way of quantising the flux operator that is usually used in Loop Quantum gravity (LQG). For this purpose we will use the same quantisation procedure that was used in quantising the Hamiltonian Constraint of LQG. In comparing the action of the alternative flux operator with the one of the usual flux operator, we can verify whether this quantisation procedure leads to the expected result.

GR 4.5 Fr 15:00 TU BH262

Singularities of General Relativity in the Framework of Loop Quantum Gravity — •Johannes Brunnemann — Max Planck Institut fuer Gravitationsphysik, Am Muehlenberg 1, D-14476 Golm

A quantum theory of gravity is expected to solve one of the main problems of General Relativity: the occurrence of singularities, such as the big bang.

Recently, remarkable progress has been made in understanding symmetry reduced cosmological models within the program of Loop Quantum Cosmology *(LQC)*, leading to striking results like the absence of a big bang singularity in these quantum-cosmologies .

One might worry, however, that the performed symmetry reductions could be too restrictive and therefore one should look at the full theory of Loop Quantum Gravity *(LQG)* in order to check the obtained results.

In this talk I will give an overview of what can be said about the (dis)appearance of classical singularities within the **full theory**, *LQG*, and show possible connections to the results within *LQC* .

GR 4.6 Fr 15:15 TU BH262

The physical Hilbert space of loop quantum cosmology — •Kevin Vandersloot, Karim Noui, and Alejandro Perez — Institute for Gravitational Physics and Geometry, Department of Physics, Pennsylvania State University, University Park, PA 16802, USA

Loop quantum cosmology currently lacks a physical inner product. Without it, wave functions can not be interpreted in terms of probability and it is not clear which states are physical (those with finite physical norm). We discuss the group averaging/path integral technique applied to loop quantum cosmology as a method of calculating the physical inner product. A simplified model of loop quantum cosmology is presented in which the physical inner product can be calculated explicitly. The implications for standard loop quantum cosmology are discussed.

GR 4.7 Fr 15:30 TU BH262

Partial and Complete Observables for General Relativity — •Bianca Dittrich — Max-Planck-Institute for Gravitational Physics, Golm and Perimeter Institute, Waterloo

We will generalize the concept of partial and complete observables introduced by Rovelli to constrained systems with an arbitrary number of first class constraints, in particular general relativity. Different methods to calculate complete observables will be presented and applied to examples.

GR 4.8 Fr 15:45 TU BH262

Gibt es eine rein differentialtopologische Interpretation von Spin-Foam-Modellen? — •Torsten Asselmeyer-Maluga — FhG FIRST, Kekulestr. 7, 12489 Berlin

Ausgehend von einem Ansatz zur Klassifikation von Differentialstrukturen auf 4-Mannigfaltigkeiten über virtuell flache Bündel wird eine Beziehung zu den Spin-Foam-Modellen hergestellt. Dabei steht die Äquivalenz zwischen Differentialstruktur und Triangulation der 4-Mannigfaltigkeit im Mittelpunkt. Zwei nicht-äquivalente Triangulationen implizieren zwei unterschiedliche Differentialstrukturen und zwei unterschiedliche Spin-Foam-Modelle. Die Konsequenzen dieses Ansatzes werden diskutiert. Insbesondere läßt sich daraus der Kontinuum-Limes des Spin-Foam-Modells konstruieren.