MP 8 Quantum Gravity

Zeit: Mittwoch 14:00–15:40 Raum: TU MA043

Fachvortrag MP 8.1 Mi 14:00 TU MA043

Quantum Dynamics of Loop Quantum Gravity — •Thomas Thiemann — Albert–Einstein Imstitute, Golm, and Perimeter Institute

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

Fachvortrag MP 8.2 Mi 14:20 TU MA043

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.

Fachvortrag MP 8.3 Mi 14:40 TU MA043

On the Universality of the Hawking Effect — •Ralf Schützhold[1] and William G. Unruh[2] — [1]TU Dresden — [2]UBC Vancouver, Canada

Addressing the question of whether the Hawking effect depends on degrees of freedom at ultra-high (e.g., Planckian) energies/momenta, we propose three rather general conditions on these degrees of freedom under which the Hawking effect is reproduced to lowest order. As a generalization of Corley's results, we present a rather general model based on non-linear dispersion relations satisfying these conditions together with a derivation of the Hawking effect for that model. However, we also demonstrate counter-examples, which do not appear to be unphysical or artificial, displaying strong deviations from Hawking's result. Therefore, whether real black holes emit Hawking radiation remains an open question and could give non-trivial information about Planckian physics.

Fachvortrag MP 8.4 Mi 15:00 TU MA043

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* .

Fachvortrag MP 8.5 Mi 15:20 TU MA043

Wodurch ist die Geometrie von 3-Mannigfaltigkeiten bestimmt? — •Torsten Asselmeyer-Maluga — FhG, Kekulestr. 7, 12489 Berlin

Die einzigartige Vielfalt an Differentialstrukturen auf 4-Mannigfaltigkeiten ist nicht nur eine mathematische Kuriosität, sondern gewinnt zunehmend an Bedeutung bei der Diskussion in der Quantengravitation: selbst solche topologisch trivialen Räume wie der 4-dimensionale Euklidische Raum besitzt unendlich viele unterschiedliche Differentialstrukturen.

Im Vortrag wird ausgehend von einer Analyse der Differentialstrukturen in 4 Dimensionen mittels virtuell flacher Bündel und dem Spektrum eines Dirac-Operators eine eingebettete Homologie-3-Sphäre konstruiert. Durch eine Beziehung zwischen dem Dirac-Operator auf der 4- und 3-Mannigfaltigkeit wird nun eine Korrespondenz zwichen den Geometrien (im Sinne von Thurston) auf der Homologie-3-Sphäre und den unterschiedlichen Differentialstrukturen der 4-Mannigfaltigkeit hergestellt. Die Auswirkungen auf eine mögliche Quantengravitation werden diskutiert.