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Fakultät für Mathematik

Mathematisches Kolloquium

EINLADUNG

Roland Steinbauer
(Universität Wien)

"The Singularity Theorems of General Relativity in Low Regularity"

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Abstract: General Relativity - Albert Einstein's theory of space, time and gravitation - has not only just celebrated its centenary but has seen the direct confirmation of one its most spectacular predictions a few weeks ago: the emission of gravitational waves from a binary black hole merger. At the mathematical core of GR lies Lorentzian geometry, which traditionally has been formulated in the smooth category. However, as a physical theory GR rests upon field equations and questions of regularity are crucial. While this mismatch has been out of focus for a long time, recent years have seen an increasing interest in Lorentzian geometry in low regularity. In this talk we report on a long-term project devoted to the study of Lorentzian geometry with a non-smooth metric tensor. On the one hand we have explicitly studied relevant model geometries with metrics of e.g. locally Lipschitz or merely distributional regularity, most notably impulsive gravitational waves. In such geometries which provide a simple model for the propagation of short but violent bursts of gravitational radiation, we have established results on geodesic completeness hence showed that they are free of space time singularities. On the other hand the famous singularity theorems of Penrose and Hawking provide physically realistic criteria which lead to the presence of singularities. While the classical proofs only work in the case of smooth (actually C^2-)metrics the conceptionally most satisfying and natural regularity class for these results is $C^{\{1,1\}}$ (i.e., the first order derivatives of the metric being locally Lipschitz). We develop causality theory in this regularity class and combine it with a regularisation technique adapted to the light cone structure of the spacetime to provide proofs for both the Hawking and the Penrose singularity theorem in $C^{\{1,1\}}$. Finally we discuss further prospects and future lines of research in this area.

Zeit: Mittwoch 15. Juni 2016
15.45 Uhr Kaffeejause,
16.15 Uhr Vortrag,
vinum cum pane im Anschluss

Ort: Fakultät für Mathematik,
Oskar-Morgenstern-Platz 1,
Sky Lounge

Herwig Hauser
Nils Carqueville
Harald Rindler