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FAKULTÄT FÜR MATHEMATIK  
Dekan Univ.-Prof. Dr. Christian Krattenthaler

Einladung zur öffentlichen Defensio von

**Dipl.-Math Alexander Lecke**

Thema der Dissertation:

**Non-smooth Lorentzian geometry and causality  
theory**

Abstract:

The classical way of understanding general relativity is to understand smooth Lorentzian geometry. However, this implies that the extension of methods and notions to (global) non-smooth settings can be demanding tasks. Nevertheless, non-smooth spacetimes (for example impulsive waves) are physically relevant. In this talk we transfer some concepts of Lorentzian geometry to the setting of Lorentzian manifolds with metric  $g \in \mathcal{C}^{1,1}$  and lower regularity. Our first aim is to analyze the causal structure of a Lorentzian manifold  $M$  with continuous metric and give requirements such that the future/past lightcone of every point  $p \in M$  is open. We discover that this question is closely related to the regularity of the curves which we consider. This leads to the introduction of a calculus of variations in generalized smooth functions. We conclude our study by investigating geodesics in nonexpanding impulsive gravitational waves in spaces of constant curvature.

Prüfungssenat:

Univ.-Prof. Dr. Josef Hofbauer (Vorsitz)  
(Universität Wien)

ao. Univ.-Prof. Mag. Mag. Dr. Michael Kunzinger  
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Prof. Dr. James Grant  
(University of Surrey)

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**Ort:** Fakultät für Mathematik, Besprechungsraum 03. Stock, Oskar-Morgenstern-Platz 1