EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Mathematisch-Naturwissenschaftliche Fakultät

Fachbereich Mathematik

AB Geometrische Analysis, Differentialgeometrie und Relativitätstheorie

Sommersemester 2024

Vorlesung

Mathematical Relativity

Lecturer: Dr. Rodrigo Avalos

Start: Tuesday, 16th April 2024

Time: Tuesdays, 10:00-12:00 and Thursdays, 10:00-12:00

Place: Hörsaal N14 / M1 (C-Bau Mathe/Physik)

Tutorial: 2 hours/week **Tutor:** Saradha Senthil Velu **Start:** Wednesday, 24th April 2024.
Time: Wednesdays, 12:00-14:00 **Place:** C6H10 / S10 (C-Bau Mathematik/Physik)

Study programs: Master in Mathematics and in Mathematical Physics

Modul number: MAT-65-13; 9 ECTS points
Study areas: semi-Riemannian geometry; mathematical physics and gravitational physics

Language: English

Description:

The objective of the course is to provide an introduction to the theory of general relativity from a mathematical perspective. Being Lorentzian geometry the geometric language for this theory, we shall provide an introduction to it and also an overview of physical preliminaries related to special relativity. Afterwards, we will introduce the full theory of general relativity and the Einstein equations. We will first study some special solutions and their geometric properties, and then present some general results concerning properties of the Einstein equations through their initial value formulation. We will then concentrate on the analysis of isolated gravitational systems, in particular static and stationary ones modeling equilibrium configurations. After some preparations, we shall then prove the Bunting–Masood-ul-Alam static black hole uniqueness theorem.

Prerequisites:
Prior knowledge on differential geometry and elementary Riemannian geometry will be assumed. The corresponding topics are covered in the Geometry in Physics or Differential Geometry courses.

Literature:

1. B. O'Neil, Semi-Riemannian Geometry with Applications to Relativity, Academic Press Inc. (1983).
2. Y. Choquet-Bruhat, General Relativity and the Einstein Equations, Oxford University Press Inc. (2009).
3. R. M. Wald, General Relativity, The University of Chicago Press (1984).
4. S. W. Hawking und G. F. R. Ellis, The large scale structure of space-time, Cambridge Monographs on Mathematical Physics (1973)

Exam: The final examination will be oral and, to be admitted to it, students will need to get 50% of all points on the exercise sheets.