Blockvorlesung „Black Holes"

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Seminarraum 267, Appelstraße 2

07.06. – 10.06.2022

10.00 – 12.00 Uhr und 14.00 – 16.00 Uhr

Course summary: This is an intensive course aimed at a graduate level theoretical/mathematical/astro-physics student (Master's). Advanced bachelor's students, PhD students and postdocs who wish to learn more about black holes are also welcome. Comfort with undertaking calculations in general relativity (GR) required (see Prof. Olaf Lechtenfeld's GR course (SoSe 2022)). Knowledge of differential geometry of pseudo-Riemannian manifolds can be used as a substitute for GR (Recommendations for GR below). Some knowledge of mathematica will prove useful in performing calculations faster.

Outline of the course:
1. Stellar Collapse + Setting up calculations with Mathematica (1 Lecture)
2. Classical black hole geometries in 4d (4 Lectures incl. Penrose diagrams)
3. Penrose-Carter diagrams
4. Black hole mechanics (1 Lecture)
5. Black hole thermodynamics, Hawking radiation (2 lectures)

General relativity recommendations (for brush up):
Resources for physicists:
Lecture notes by Matthias Blau (Bern) - Available Online
General Relativity - Robert Wald
Spacetime & Geometry - Sean Carroll

Resources for mathematicians/mathematical physicists:
General Relativity for Mathematicians - Sachs & Wu
Large Scale Structure of Spacetime - Hawking & Ellis
Semi-Riemannian Geometry - O'Neill
General Relativity - Robert Wald