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BLACK HOLES I (136.028)

Winter semester 21/22

Location: TUWEL (online teaching plus Q&A sessions)

Time: TBA (starting October 2021)

Summary:

Black holes have advanced to the forefront of current research in various disciplines: besides the obvious ones, general relativity, mathematical physics and astrophysics, also string theory, quantum chromodynamics, cosmology, computational physics, quantum gravity and even part of condensed matter physics devote a significant fraction of their resources to the study of black holes. It is thus both a fascinating and timely subject to investigate.

The main purpose of this lecture is a comprehensive introduction to black hole physics.

Contents:

- History of black holes
- Phenomenology of and experiments with black holes
- Gravitational collapse and Chandrasekhar limit
- Metric and geodesic equation
- Geodesics for Schwarzschild black holes
- Curvature and basics of differential geometry
- Hilbert action and Einstein equations
- Spherically symmetric black holes and Birkhoff theorem
- Rotating black holes: the Kerr solution
- Geodesics for Kerr black holes
- Accretion disks and black hole observations
- Black hole analogs in condensed matter physics



webpage: <http://quark.itp.tuwien.ac.at/~grumil/teaching.shtml>