

Relativitätstheorie und Kosmologie I: Exam questions

- 1 Maxwell equations and Galileo invariance.
- 2 The wave equation and the origin of the Lorentz group.
- 3 The Minkowski metric, the inverse Cauchy-Schwarz inequality, examples of Lorentz transformations.
- 4 Lorentz contraction, time dilation, the twin paradox.
- 5 Addition of velocities, Fizeau's experiment
- 6 Proper time, uniform acceleration, photons in special relativity.
- 7 Doppler effect, aberration of light.
- 8 Decay of particles, Compton effect.
- 9 Lagrangian field theory: Euler-Lagrange equations, canonical and symmetric energy-momentum tensors, examples (including dust for the energy-momentum tensor).
- 10 Introduction to tensor calculus: scalars, vectors, covectors, covariant derivative.
- 11 The curvature tensor and its properties.
- 12 Basic principles of general relativity and their implications.
- 13 The Levi-Civita covariant derivative, local inertial coordinates. (**Not for students in 2020W.**)
- 14 The linearized Einstein equations, post-Newtonian limit. (**Not for students in 2020W.**)

For students in WS 2018/19:

- 15 Inelastic and elastic collisions.
- 16 Maxwell tensor, Maxwell equations and their invariance.
- 17 Tidal forces, the geodesic deviation equation.
- 18 The Schwarzschild metric
- 19 Vector potential, gauge invariance, Lorenz gauge.
- 20 Lorentz equations of motion; Maxwell Energy-Momentum tensor and its properties.