

- 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 Inelastic and elastic collisions.
- 10 Maxwell tensor, Maxwell equations and their invariance.
- 11 Vector potential, gauge invariance, Lorenz gauge.
- 12 Lorentz equations of motion; Maxwell Energy-Momentum tensor and its properties.
- 13 Lagrangean field theory: Euler-Lagrange equations, canonical and symmetric energy-momentum tensors, examples.
- 14 Introduction to tensor calculus: scalars, vectors, covectors, contractions.
- 15 The Levi-Civita covariant derivative, local inertial coordinates.
- 16 The curvature tensor and its properties.
- 17 Energy-momentum tensor of dust, its properties. The linearized Einstein equations.