

Analytical Dynamics: Syllabus - Tobias Schäfer

1. Newtonian Mechanics

- Fundamental principles. One-dimensional motion.
- Principle of d'Alembert.

2. Lagrangian Dynamics

- Calculus of Variations.
- Two-Body Problem.
- Scattering.
- Noether Theorem.
- Small oscillations.

3. Motion of the Rigid Body

- Euler Equations.
- Euler Angles.
- The heavy symmetric top.

4. Hamilton Theory

- Legendre transformation. Phase space. Liouville's theorem.
- Poincaré recurrence. Canonical transformations. Generating functions.
- Symplectic structure. Poisson-brackets. Hamilton-Jacobi theory.
- Integrability. KAM-theorem. Adiabatic invariants.
- Nonlinear Dynamics

5. Theory of Special Relativity

- Historical remarks. Lorentz transformations.
- Equivalence of energy and mass.
- Relativistic formulation of Lagrange and Hamilton formalism.

Literature:

1. Landau and Lifshitz, Mechanics
2. Goldstein, Classical Mechanics
3. Jose/Saletan, Classical Dynamics
4. David Tong, Lectures on Classical Dynamics
online at <http://www.damtp.cam.ac.uk/user/dt281/dynamics.html>