

**lecture 1** Introduction. Abelian gauge theories and the QED lagrangian.

**lecture 2** Non-abelian gauge theories

**lecture 3** Further properties of non-abelian gauge theories and the QCD lagrangian.

**lecture 4** Gauge-fixing of the abelian gauge theory, Faddeev-Popov ghosts, BRST symmetry.

**lecture 5** BRST symmetry, auxiliary field, BRST quantization.

**lecture 6** Gauge-fixing of non-abelian gauge theories: Faddeev-Popov method and BRST quantization.

Gauge fixing of gravity.

**lecture 7** Perturbative gravity and graviton propagator. Cohomology.

**lecture 8** Cohomology and the BRST charge. Physical operators and states. The Batalin-Vilkovisky method.

**lecture 9** Classical and quantum master equation.

**lecture 10** Feynman rules for QCD: propagators and vertices. The QCD beta function.

**lecture 11** Ward identities and gluon polarization. Background field method in scalar theory.

**lecture 12** Background field method in gauge theories.