

Phys. 591. Gauge Field Theory

Typical Textbook: Stefan Pokorski GAUGE FIELD THEORIES

I Gauge invariance

1. Abelian gauge invariance
2. Elements of group theory
3. Non-Abelian gauge invariance
 - 3.1. Yang-Mills theory.
 - 3.2. Equations of motion

II Singular theories

1. Hamiltonian formalism for the systems with constraints
2. Theories with first and second class constraints
3. Lagrangian formalism, first class constraints, gauge invariance

III Canonical quantization of singular theories

1. Dirac quantization
2. Generating functional of Green functions
3. Functional (path) integral
4. Faddeev-popov determinant and FP ghosts
5. Representation of the generating functional of Green functions in the form of the path integral

IV Canonical quantization of physical models

1. Quantization of QED
2. Models with Yang-Mills theories
 - 2.1. Dirac quantization
 - 2.2. Generating functional. Ward identities

V Lagrangian quantization of gauge theories

1. Effective action for Yang-Mills theory
2. Operator formulation
3. Canonical quantization of the effective Yang-Mills action
4. BRST charge and BRST quantization

VI Introduction to the theory of renormalization

1. Renormalization technique in QED and QCD.
2. Renormalization group equations

3. Anomalies

4. Asymptotic freedom

VII Spontaneous symmetry breaking

1. Global symmetry breaking

2. Spontaneous breaking of gauge symmetry, Higgs mechanism