

Syllabus

1. **Basics:** Classical Field Theory/Quantum Mechanics, including Lagrangian, action, equation of motions, conserved current and charges in classical fields; Dirac's canonical quantization, Heisenberg and Schrödinger's pictures.
2. **Free Fields and Their Quantizations:** Representations of Lorentz group; Spin-0, 1/2, 1 free fields and their solutions and quantization; Global symmetry v.s. gauge redundancy;
3. **Interacting Fields and Their Correlation Functions:** Interaction picture and Dyson formula; Correlation function and Wick theorem; Path integral formalism; Scattering amplitudes and Feynman diagrams; Ward Identity; Schwinger-Dyson equations; Path integral in statistical mechanics.
4. **Renormalization:** Generics in renormalization; Renormalization in perturbative QFTs; Case study: ϕ^4 -theory, QED; Renormalization group.
5. **Topics in QFTs:** Non-abelian QFTs; Standard model; Supersymmetric QFTs and index theorems; Generalized global symmetries; quantum anomalies and topological orders.