

Outline

Standard Model and Beyond

Lecture I: Gauge theory

Gauge invariance, gauge interactions, conserved charges and currents, mass problem, spontaneous symmetry breaking, Higgs mechanism, gauge fixing and ghost terms in the Lagrangian.

Lecture II: The Standard Model

Weak interactions, construction of the Standard Model, $SU(2)\times U(1)$ generators and currents, spontaneous breaking of $SU(2)\times U(1)$, inclusion of fermions, the CKM matrix and flavour mixing, oblique corrections and precision tests (if time permits).

Lecture III: Beyond the Standard Model

Minimal extensions, e.g. 2HDM and exotic fermions, extended symmetries, GUTs (in brief), problems with the SM, possible solutions, incl. SUSY.

Collider Physics

Lecture I: Electron-positron colliders

Advantages and problems of the collider design, e^+e^- colliders, impact factor and luminosity, kinematic variables, observables, requirement of MC simulations.

Lecture II: Hadron Colliders

Advantages and problems of a hadron collider, parton density functions, hadronisation and jets, tagging of heavy particles, kinematic variables, missing p_T and its importance, exotic variables

Lecture III: New Physics at Colliders

Techniques to search for new physics, extra fermions and bosons, supersymmetry, simplified models, extra dimensions, effective theories and the inverse problem.