Outline

Quark-Gluon Plasma (Lecture nos. 1-3)

1. Introduction and overview; Similarities with cosmology; General remarks about phase transitions, critical points; Lattice QCD, QCD phase diagram; Big picture.

2. Relativistic kinematics for RHIC and LHC; Bjorken picture; Various stages of evolution and the corresponding time scales; Standard model of relativistic heavy-ion collisions.

3. Thermodynamics and EoS of quarks, antiquarks and gluons; Thermodynamics and EoS of hadron gas; Hagedorn temperature; EoS and QCD phase diagram from MIT bag model; EoS based on lattice QCD.

4. Relativistic transport theory, relativistic Boltzmann equation. Relativistic dissipative fluid dynamics; Causal and acausal theories; Bjorken and Landau hydrodynamics; Thermal or hydrodynamic noise, deterministic and stochastic hydro.

5. Initial-state models: Glauber; Colour-glass condensate + glasma.

Heavy-Ion Collisions Phenomenology (Lecture nos. 4-6)

1. Geometry of collision, reaction plane; Initial-state fluctuations, participant plane, complex eccentricity to characterize initial-state anisotropy; Event plane, complex flow to characterize final-state anisotropy.

2. Soft and hard sectors, the main observables; Modern picture of collective flow, flow and nonflow correlations, two- and multiparticle correlations, cumulants; Various flow analysis methods; Jet quenching, R_AA and R_cp.

3. Particlization, freezeout; Observables: strangeness enhancement, J/psi and upsilon suppression, particle abundance ratios, HBT correlations, constituent-quark-number scaling, long-range rapidity correlations, symmetric cumulants and event-plane correlations, electromagnetic probes.

4. Recent advances and open questions.