

In these lectures I present the key ideas driving the field of relativistic heavy ion physics and develop in a brief way some of the theoretical tools needed for the description and interpretation of heavy-ion collision experiments.

I will start by an introduction where I describe the main features of Quantum Chromodynamics (QCD), i.e. asymptotic freedom and deconfinement, and also the partition function from Lattice QCD.

The phase diagram of nuclear matter and the transition to the Quark Gluon Plasma (QGP), together with the recent advances in the search for the QGP and its signatures are discussed in an extended way: stopping and jet quenching as a signature of creation of dense nuclear matter, collective flow as a tool of compression of nuclear matter, strangeness enhancement and hadrons abundances as a signal of chemical equilibrium and restoration of chiral symmetry, J/ψ suppression as a signature of color screening in a dense QGP and thermal dileptons and direct photons as indication of radiation of a hot plasma.

I will conclude with a discussion on the high density regime and the saturation in the initial state.