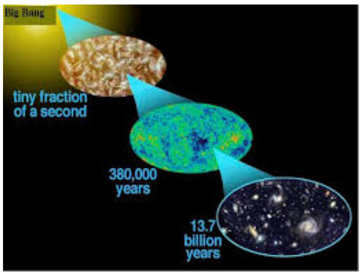

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NJL Model and QCD phase transition

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Quantum Chromodynamics (QCD) Matter Under Nambu-
Jona–Lasinio (NJL) Model and Phase Transition Temperature
Quantum Chromodynamics (QCD) is one of the fundamental and ultimate theory of strong interactions. It describes the interaction of quarks through their colour quantum numbers called colour charges. The mediating particles are gluons which are called gauge bosons with spin-zero particles and are massless. QCD deals with two extreme forms of matter in two phases. One heated to trillion degrees called QCD quenched and other maintained at zero temperature labelled as QCD vacuum. Low energy QCD deals with systems of light quarks where energy and momentum scales are smaller than 1 GeV mass energy gap observed in hadron spectrum. Right after the Big Bang, quarks and leptons were mass-less. When the temperature of the universe dropped below 100 GeV, the spontaneous breaking of the electroweak symmetry resulted in Higgs particles condensing in the vacuum, this “Higgs mechanism” gave mass to leptons and quarks. With further cooling, once the temperature dropped below 100 MeV, the quarks and gluons became confined in protons and neutrons. The QCD vacuum was modified by the spontaneous breaking of chiral symmetry giving the u (up) and d (down) quarks in the nucleon an “effective” mass of some 300 MeV. This constituent mass of the quarks is different from their current mass. The Higgs mechanism is only responsible for ~2% of the mass of the nucleon, QCD dynamically generates the remaining 98% of the mass of ordinary matter. At low energy scale which is also relevant for conventional nuclear physics, QCD exhibits two important features. One is called the color confinement and other is approximate chiral symmetry and its spontaneous breaking. In case of physical quark masses neither chiral condensate vanishes nor chiral susceptibility diverges at the pseudo-critical temperature. In spite of this these quantities retain a reminiscent behaviour of them corresponding to one in the chiral limit. In particular the chiral susceptibility has a peaked structure as a function of temperature and it is customary to define critical temperature as the temperature for which susceptibility reaches its peak.
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