GSI - Colloquium

Main Lecture Hall (SB1 1.120), 64291 Darmstadt, Planckstraße 1

Tuesday, 17 November, 2015, 16:15 Uhr (Tee ab 15:45)
Pre-colloquium for students at 15:30

Jochen Wambach / TU Darmstadt and GSI

Quark-Gluon Matter

What happens ultimately to matter upon heating and compression? This question is not purely academic but relates to cosmological settings in the early universe and the inner core of neutron stars. In this talk I will begin with a brief historical review on matter under extreme conditions, starting from theoretical observations by R. Hagedorn in the 1960s and the problem they posed at that time for Big Bang cosmology. With the advent of QCD, in which it was realized that hadrons consist of quark and gluons, this situation changed. The quark-gluon substructure opened the possibility for a transition to a new state of matter in which quarks and gluons become deconfined and can thus traverse large space-time distances. In theory a rich phase diagram has emerged which has many similarities with other substances but also distinct differences. Besides confinement another feature of QCD is chiral symmetry, which predicts nearly degenerate hadron states of opposite parity. Since this not observed in nature one has concluded that chiral symmetry is hidden or spontaneously broken. We now understand that this mechanism, which is quite common in nature, is responsible for most of the mass of light quarks. As matter is heated and compressed to the extremes, chiral symmetry is restored, i.e. light quarks will lose most of the mass that is generated by the strong interaction. Does this imply that confined hadrons also loose most of their mass? This question can be tested experimentally in relativistic heavy-ion collisions through the measurement of dilepton spectra emitted from the fireball. The answer is negative, which implies that mass generation through the strong interaction is rather complicated

Einladende/r: Bengt Friman

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