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The electroweak phase transition and spontaneous creation of magnetic fields

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There were many phase transitions during the evolution of our Universe. The electroweak phase transition and deconfinement were two of them. The electroweak phase transition happened near 100 GeV and due to Higgs mechanism the leptons, quarks and gauge bosons gained mass. The deconfinement phase transition happened near 150 MeV and quarks combined to each other, as a result baryons and mesons were created. In QCD and gluodynamics the color chromomagnetic fields B_3 and B_8 are created spontaneously at temperature $T > T_d$ higher than the deconfinement temperature T_d. Usual magnetic field H had also been spontaneously generated because of quarks loop. The quarks possess electric and color charges, as a result magnetic and chromomagnetic fields are mixing in effective potential. These fields appear spontaneously for $T > T_d$ and they were present for temperature near critical temperature of the electroweak phase transition. For T close to T_{EW} the magnetic fields could change the type of the phase transition.

We investigate the electroweak phase transition in the Standard Model with accounting the spontaneously generated magnetic and chromomagnetic fields. As it is known, for the mass of Higgs boson greater than 75 GeV this phase transition is second order. But according to Sakharov's conditions for the formation of the baryon asymmetry of the Universe it has to be strongly first order. The spontaneously generated (chromo) magnetic fields are temperature dependent. They influence the phase transition. The strength of generated fields and the critical temperature of phase transition are also estimated.

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