

## QUARK-SPIN POLARIZATION AND SPONTANEOUS MAGNETIZATION IN QUARK MATTER AT FINITE DENSITY

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One of the recent interesting and important problems about the physics governed by QCD may be to clarify the phase structure or phase diagram of QCD on the plane with respect to the temperature, baryon chemical potential or baryon number density, external magnetic field and so on. In this presentation, it is shown that the quark spin polarization occurs in the quark matter in high density and low temperature region within the Nambu-Jona-Lasinio model with a tensor-type four-point interaction between quarks, which may be regarded as an effective model of QCD. As a result, the quark spin polarized phase is realized in the region of the high baryon chemical potential, while it is believed that the colour superconducting phase may exist. Also, it is here indicated that the quark spin polarization leads to a spontaneous magnetization of quark matter due to the existence of the anomalous magnetic moment of each quark. Further, an implication to magnetic field in compact stars such as neutron stars and magnetars is discussed. Namely, if quark matter exists in the core of neutron stars, which turn out so-called hybrid stars, and the quark-spin polarized phase is realized in quark matter, then the spontaneous magnetization of quark matter give rise to a strong magnetic field such as  $10^{14}$  Gauss on the surface of compact stars.