HYPERON-QUARK MIXED PHASE IN COMPACT STARS

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In cold neutron star matter a phase transition has been expected from hadron phase, including hyperons, to quark phase. The hyperon mixture causes large softening of the equation of state (EOS) of matter and brings about too small maximum mass of neutron stars (NS), which contradicts the observation [1]. On the other hand, considering a phase transition to quark matter with harder EOS at high density, the theoretical NS maximum mass may increase to a reasonable value [2]. If this is the case, the appearance of a mixed phase during the first-order phase transition should may have large influences on the EOS and consequently on this scenario.

We investigate the property of the hadron-quark mixed phase [3] using the Brueckner-Hartree-Fock model for hadron (hyperon) phase and the MIT bag model for quark phase. To satisfy the Gibbs conditions, charge density as well as baryon number density becomes non-uniform in the mixed phase, accompanying phase separation. Then, taking into account the density distribution and the Coulomb interaction in a self-consistent way, we will clarify the roles of the surface tension and the charge screening effect. We will show that the screened Coulomb interaction tends to make the geometrical structure of the mixed phase less stable, and the resultant EOS becomes similar to the one given by the Maxwell construction.

Using the Bag-model parameters, we demonstrate that hyperons are suppressed in the mixed phase, because hadron phase is positively charged. This is a novel mechanism of hyperon suppression in compact stars.

Finally we will discuss some consequences of our EOS on the structure and the maximum mass of NS.

References

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