PROTON LOCALIZATION AND MAGNETIC FIELD EVOLUTION IN DENSE NEUTRON STAR MATTER

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Abstract

The realistic models of neutron star matter share the same property of the nuclear symmetry energy which saturates and decreases at high densities. This implies the low proton fraction in the nuclear matter. At high densities the protons behave as polarons which are localized [1]. The localized protons involve a ferromagnetic instability in the form of spin ordering. This magnetized phase in the core of neutron star generates the strong magnetic field. The density-dependent effective proton magnetic moment and magnetization change sign at some density. This involves fast decreasing to zero of the magnetic field with the neutron star mass, then again increasing [2]. We employ here the model of ferromagnetic origin of magnetic fields of neutron stars. The magnetic phase transition occurs soon after formation of the neutron star and the core magnetic field is fully screened at the beginning. The emergence of magnetic field takes a long time because of high electrical conductivity of the magnetic core [3]. We compare our results with measured neutron star masses and their magnetic fields.

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