Contribution ID: **29** Type: **not specified**

Magnetic field generation in hybrid neutron stars

Friday 22 September 2017 09:40 (40 minutes)

The mechanism of magnetic field generation in hybrid neutron stars (consisting of “npe” hadronic, “2SC”and “CFL”quark phases) is considered. We assume that rotational vortices in “npe” and “CFL”phases with quantum of circulation ħ/ are continued in “2SC”phase as well. Since superconducting matter in “npe”and “2SC”phases is charged, rotation induced entrainment currents arise around vortices, which generate magnetic field. Mean value of generated magnetic field is about 1016Gs and exceeds one in “npe”phase by 3-4 orders of magnitude. The magnetic field enters the vicicnity of rotational vortices forming the clusters of magnetic vortices with quantum of magnetic flux Φ0 in “npe”phase and 2Φ0 in “2SC”phase. The radii of clusters are 0.1 and0.3, respectively, in “npe”and “2SC”phases, where is a radius of rotational vortex. Magnetic field penetrates in “CFL” phase via magnteic vortices with magnetic flux2Φ0. In “npe”phase this magnetic field can destroy proton superconductivity. Magnetic field on the surface of a star reaches the value of 10 15Gs, which is
comparable with magnetic field of magnetars. Therefore magnetars are candidates of compact objects containing quark matter.
Due to high density of magnetic energy of vortices, vortex-free zone appears at the bound of “2SC”phase with width about several hundred meters. An outward motion of vortices during spindown of a star leads to energy release when vortices reach to the boundary of vortex-free zone.
Magnetic energy of annihilated vortices may become the source of high-frequency radiation of objects like SGR and AXP.

Type of contribution

Invited talk

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