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Appearance of a quark matter phase in hybrid stars

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Appearance of a quark matter in the core region of hybrid stars is the main issue in such compact stars because the central density of the star is sufficiently high for the nuclear matter to undergo a further change into other exotic phase which consist of hyperons and quarks. Therefore a quark matter is expected in the core region but many theoretical calculation suggest that the inner structures of the star are strongly depend on the equation of states (EOS) of the matters. However the EOS for the high density matter is still not clear and recent several observations indicate the restrictions of the EOSs, theoretical studies should try to elucidate the EOSs in the high density and/or temperature. It is believed that the crust region of the stars consist of nucleus and nuclear matter and therefore the inner region of the stars should have hadron-quark mixed phase. We study the hadron-quark mixed phase with taking into account the finite-size effects and find that the mixed phase should be restricted to a narrower region, therefore a quark matter phase should appear in the central region[1]. Many studies show that the inner structures would affect macroscopic phenomena of the star, for instance, the quark core would give a new cooling curve[2].

References:

[1] T. Endo, Phys. Rev. C 83, 068801 (2011).

[2] R. Negreiros, V.A. Dexheimer and S. Schramm, Phys. Rev. C85, 035805(2012).

Primary author: Prof. ENDO, Tomoki (Kagawa National College of Technology)

Presenter: Prof. ENDO, Tomoki (Kagawa National College of Technology)

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