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Pasta Structures of Quark-Hadron Phase Transition in Proto-Neutron Stars

Nobutoshi Yasutake, Toshiki Maruyama, Toshitaka Tatsumi

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We study the quark-hadron mixed phase in proto-neutron stars with the finite-size effects. In the calculations of pasta structures appeared in the mixed phase, the Gibbs conditions require the pressure balance and chemical equilibrium between two phases besides the thermal equilibrium. We find that the region of the mixed phase is limited due to thermal instability. Moreover, we study the effects of neutrinos to the pasta structures. As a result, we find that the existence of neutrinos make the pasta structures unstable, too. These characteristic features of the hadron-quark mixed phase should be important for the middle stage of the evolutions of proto-neutron stars.

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