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## Inhomogeneous chiral phase in the QCD phase diagram and cooling of hybrid stars

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Recently there has been much discussed the appearance of inhomogeneous chiral phases in the vicinity of the chiral restoration [1,2]. The critical end point should be the Lifshitz point, which properties have not been explored so much. Here we discuss an implication of inhomogeneous phase on cooling of hybrid stars.

We consider the dual-chiral-density-wave (DCDW) specified by the spatially modulated quark condensates with amplitude  $\Delta$  and wave number  $q$  [1], and study the beta decay of quarks. Since the DCDW state can be represented as a chirally rotated state, the quark weak-current is accordingly transformed to have an additional phase factor which modifies the energy-momentum conservation at the vertex. The direct evaluation of the neutrino luminosity shows that it is proportional to  $\Delta^2 q^2 T^6$ , which exhibits a similar form to the pion cooling [3]. Since the DCDW phase develops only in the limited density region, this novel mechanism may give an interesting scenario that lower mass stars should be cooler than heavy-mass ones, which has been also proposed to explain the recent data of Cas A in the context of color superconductivity [4].

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