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# Thermal Relaxation of Neutron Stars near the Direct Urca Onset

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In this work we revisit the thermal relaxation of neutron stars. We focus particularly on the cooling of neutron stars whose mass is slightly greater than the value above which the direct urca process sets in. Considering different mechanisms for neutrino production in each region of the star, and working with some equations of state whose saturation properties as well its predicted neutron star maximum mass were previously tested with empirical values, we solve numerically the differential equations of energy balance and heat transport for a star with macroscopical structure given by the TOV equation. We show that the star in that condition exhibits neither a fast cooling, nor a slow cooling as they are commonly presented in the literature. Contrary to common behavior, its surface temperature undergoes a second sudden drop and the relaxation time is unusually high, reaching a few hundreds of years in some extreme cases.

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