Abstract Submitted
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Resolving Urca cooling reaction layers in neutron stars ALEX DEIBEL, Michigan State University, JINA-CEE COLLABORATION[1] — Reaction network calculations predict that the crust of an accreting neutron star should host Urca reactions: e^--capture/β^--decay cycles that cool the crust through neutrino emission. Neutron star transients offer an opportunity to test this prediction. During accretion outbursts, the crust of a neutron star transient reaches temperatures above $T > 2 \times 10^8$ K where Urca cycling is expected to balance the accretion-driven crust heating. However, post-outburst thermal evolution models of the hottest transient MAXI J0556-332 have shown that the Urca cooling reactions must take place deeper in the star than predicted, or must be absent entirely, in order to fit quiescent observations. In order to reconcile the predictions from nuclear reaction networks and post-outburst thermal evolution models, we model the Urca reaction layer with higher resolution than ever before. This modeling allows us to incorporate measured e^--capture rates and follow the temperature evolution of the reaction layer on relatively small scales. These developments in reaction layer modeling will not only help delineate the effects of Urca cooling on neutron star crusts, but will aid in incorporating Urca cooling in X-ray burst models.

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