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Constraints on Bygone Neutron Star Nucleosynthesis Using Urca Coolers in the Crust[1] ZACH MEISEL, Institute of Nuclear and Particle Physics, Ohio University, ALEX DEIBEL, Michigan State University (Present: Indiana University) — Nuclear burning near the surface of an accreting neutron star produces ashes that, when compressed deeper by further accretion, alter the star's thermal and compositional structure. Bygone nucleosynthesis can be constrained by the impact of compressed ashes on the thermal relaxation of quiescent neutron star transients. In particular, Urca cooling nuclei pairs in nuclear burning ashes, which cool the neutron star crust via neutrino emission from e^-/β-decay cycles, provide signatures of prior nuclear burning over the ∼century timescales it takes to accrete to the e^--capture depth of the strongest cooling pairs. This talk will present crust cooling models of the accreting neutron star transient MAXI J0556-332 used to show that this source likely lacked Type I X-ray bursts and superbursts ≥120 years ago. We also identify the key nuclear physics uncertainties in rp-process reaction rates and e^--capture weak-transition strengths for low-lying transitions whose reduction will improve nucleosynthesis constraints using this technique.

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