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### **Rare Isotopes Heating and Cooling the Crust of Accreting Neutron Stars**

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Observations of accreting neutron stars in X-ray binaries provide a unique window into the structure of neutron stars and the properties of dense matter. Observables such as thermonuclear bursts and cooling behavior are strongly affected by nuclear processes in the crust that involve neutron captures and beta decays on extremely neutron rich rare isotopes. These nuclear processes control nuclear heating, neutrino cooling, and compositional changes that affect thermal transport and need to be understood to interpret X-ray observations. The challenges for nuclear physics are similar to understanding the extremely neutron rich nuclei in the r-process. I will discuss recent progress in delineating the nuclear processes in accreting neutron stars, including a novel neutrino cooling process based on electron-capture and beta decay Urca cycles on nuclei in the outer crust. I will also discuss attempts to address the nuclear physics questions through laboratory measurements at rare isotope facilities and the prospects of obtaining most of the nuclear data in the near future with the new FRIB accelerator facility.