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Thermonuclear runaways investigated using drip line beta decays

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In close binary star systems, mass transfer onto the surface of a white dwarf or neutron star can lead to spectacular periodic emissions including classical novae and x-ray bursts. Accurate nuclear reaction rates are needed to model energy generation and nucleosynthesis in these thermonuclear runaways enabling meaningful comparisons to observations. An experimental program has been established at the National Superconducting Cyclotron Laboratory to constrain the most influential nuclear physics uncertainties using the beta decays of nuclides adjacent to the proton drip line. In particular, the beta decays of ^{20}Mg, ^{26}P, and ^{31}Cl have been used to investigate the ^{15}O(α,γ)^{19}Ne, ^{25}Al(p,γ)^{26}Si, and ^{30}P(p,γ)^{31}S reaction rates, respectively. These studies relate to the shapes of x-ray burst light curves, the production of the radionuclide ^{26}Al in the Milky Way, and the identification of presolar nova grains in meteoritic material.