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New results in neutron star crust nucleosynthesis and implications for X-ray Superburst ignition SANJIB GUPTA, PETER MOLLER, TOSHIHIKO KAWANO, Los Alamos National Laboratories, DANIEL PAGE, UNAM, Mexico City — The heating in neutron star (NS) crusts is due to Electron Capture (EC) and neutron emission/capture reactions. The shallow crustal heating is sensitive to the composition of X-ray burst ashes from explosive burning on the NS surface. Beyond the neutron-drip point the EC-delayed neutron-emissions and resulting neutron-captures onto more tightly bound nuclei drive the composition rapidly toward the cold-catalyzed state, and compositional memory is erased. This has important implications for the thermal conductivity and neutrino emissivity of the inner crust, and also for the thermal profile that results from the nuclear heating. The new nucleosynthesis process deposits a substantial amount of heat very close to neutron-drip (greater than 2 MeV/u). This is in contrast to heating concentrated near the crust-core interface in models relying mostly on pycnonuclear fusion. The new heating location and the erasure of compositional memory directly affect the thermal profiles we can expect for NS that are X-ray Superburst progenitors. The implications for X-ray Superburst ignition by carbon fusion will be discussed.

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