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Heating from Electron Captures in the Crusts of Accreting Neutron Stars[1] SANJIB GUPTA, EDWARD BROWN, HENDRIK SCHATZ, Dept. Physics and Astronomy, National Superconducting Cyclotron Laboratory, and Joint Institute for Nuclear Astrophysics, Michigan State University, PETER MÖLLER, Theoretical Division, Los Alamos National Laboratory, KARL-LUDWIG KRATZ, Institut für Kernchemie, Universität Mainz — We present new calculations of nuclear reactions in the outer crust (densities less than neutron drip) of an accreting neutron star. Our crust model improves on previous work by starting with a realistic distribution of nuclei and by allowing for electron captures into excited states, rather than just transitions into the ground state. We find that the heat deposited in the outer crust is substantially larger (factor of 4) than previous estimates and that the amount of heat deposited depends strongly on the composition of matter synthesized during rp-process burning of accreted hydrogen and helium. This increased heating raises the temperature in the crust and makes the unstable ignition of carbon—which is thought to power superbursts observed from some accreting neutron stars—occur at lower density. This alleviates some of the discrepancy between the ignition depth inferred from observations and theoretical superburst models.

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