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Nuclear reactions in the crust of an accreting neutron star KIT YU LAU, A.V. AFANASJEV, M. BEARD, E. BROWN, L.R. GASQUES, S. GUPTA, W.R. HIX, K.L. KRATZ, P. MOLLER, H. SCHATZ, A. STEINER, M. WIESCHER, D.G. YAKOVLEV — Recently there have been many discoveries from observations of accreting neutron stars in x-ray binaries. Many of the observed phenomena such as superbursts or the cooling of quasi-persistent transients during their quiescent state are affected by the thermal properties and the composition of the crust. To model the nuclear energy release and crust compositions, we run a consistent nuclear reaction network that follows the evolution of an accreted fluid element from the atmosphere down to the inner crust, where free neutrons exist in beta-equilibrium. We take into account a majority of the most important nuclear processes including electron capture, neutron capture, neutron emissions, β decay, and pycnonuclear fusion reactions. Our calculations show that pycnonuclear fusion reactions can occur at a shallower depth than previously thought, depending on the nuclear mass model used.

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