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Phase Diagrams of Nuclear Pasta MATTHEW CAPLAN, CHUCK HOROWITZ, DON BERRY, Indiana University, ANDRE DA SILVA SCHNEIDER, California Institute of Technology — In the inner crust of neutrons stars, where matter is near the saturation density, protons and neutrons arrange themselves into complex structures called nuclear pasta. Early theoretical work predicted a simple graduated hierarchy of pasta phases, consisting of spheres, cylinders, slabs, and uniform matter with voids. Previous work has simulated these phases with a simple classical model and has shown that the formation of these structures is dependent on the temperature, density, and proton fraction. However, previous work only studied a limited range of these parameters due to computational limitations. Thanks to recent advances in computing it is now possible to survey the structure of nuclear pasta for a larger range of parameters. By simulating nuclear pasta with constant temperature and proton fraction in an expanding simulation volume we are able to study the phase transitions in nuclear pasta, and thus produce a set of phase diagrams. We report on these phase diagrams as well as newly identified phases of nuclear pasta and discuss their implications for neutron star observables.

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