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The nuclear symmetry energy dependence of the nuclear "pasta" phases in the inner crust of neutron stars MICHAEL GEARHEART, Texas A&M University - Commerce — Neutron stars are the end point of the evolution of a star with between about 8 and 25 solar masses. The star's core collapses to form an object with about 1.5 times the mass of our Sun and a radius of only 10km. The average density of matter in a neutron star is comparable with that of the nuclei of atoms, making them interesting probes of nuclear physics in a regime inaccessible to terrestrial experiments. We present a study of the inner crust of neutron stars, a region of the star between 0.5km and 1km in depth where super-heavy neutron rich nuclei arranged in a lattice co-exist with a gas of neutrons. Near the transition from the inner crust to the core of the star, the nuclei are expected to assume exotic shapes such as cylinders and slabs, referred to collectively as nuclear 'pasta'. Using a compressible liquid drop model and a variety of different descriptions of the nucleon-nucleon interaction, we examine the composition and shape of nuclei at different depths in the inner crust up to the point where the nuclei dissolve into a uniform fluid of neutrons, protons and electrons. We examine the dependence of the densities at which nuclear shape transitions through various forms of the surface energy using experimentally measurable properties of nuclear matter such as the nuclear symmetry energy, comparing our results with that of measured nuclei masses.

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