Abstract Submitted
for the BPNMC18 Meeting of
The American Physical Society

Spin-1 Ising model simulations of Nuclear pasta DANIEL SILVA, Florida State University — To construct neutron star crust models requires knowledge of condensed matter and statistical physics. We use a lattice model and Monte Carlo sampling to simulate nuclear pasta, a frustrated phase of matter which is thought to occur near the bottom of the inner crust of a neutron star. Frustration, a phenomenon characterized by the existence of a very large number of low-energy configurations, occurs because it is impossible to simultaneously minimize all elementary interactions. Somewhat above 10^{17} kg m^{-3} nuclei can no longer exist, they coalesce into a uniform plasma of nearly-pure neutron matter with a few percents of protons and electrons. The potential energy in the inner crust of a neutron star consists of a sum of a short-range nuclear interaction between nucleons and a long-range Coulomb interaction between protons, treating the electrons as a uniform gas. We compute the long-range interaction using the Ewald method. We model the short-range nucleon interaction as a nearest-neighbor Ising interaction in a grand-canonical ensemble. This simple model should capture the Coulomb frustration of the neutron-star matter. We probe the parameter space of the spin-1 Ising model which can reproduce the conditions of nuclear pasta, that is extreme isospin asymmetry.

Daniel Silva
Florida State University

Date submitted: 15 Oct 2018 Electronic form version 1.4