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Bayesian inference of neutron star crust properties from neutron skin and neutron matter constraints[1]

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We present the first consistent and direct inference of the thickness, mass and composition of the crust and the nuclear pasta layers therein from neutron skin measurements and neutron matter simulations. Using an extended Skyrme model which allows independent variation of the first three symmetry energy coefficients J, L and $K_{\rm sym}$ at saturation density, we generate several hundred Skyrme models and calculate the neutron skins of ^{48}Ca ^{208}Pb and a number of Tin isotopes. We perform MCMC sampling from these results to infer the posterior distributions of the symmetry energy parameters using a number of different priors including ones derived from the results of chiral effective field theory calculations of pure neutron matter. We then sample Skyrme models from the posterior distribution and, within a compressible liquid drop model of the crust fit to the results of 3D Hartree-Fock calculations of the crust, we calculate the posterior distributions of crust and pasta properties.

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