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**Structure of Neutron Star Crusts**[1] CHRISTIAN BRIGGS, Indiana University REU Program, CHUCK HOROWITZ, Indiana University, THOMAS DOMBROSKI, Indiana University REU Program — Very dense matter in neutron star crust forms a crystal wherein columbic repulsion of the nuclei is the dominant force. To characterize this lattice, we calculate radial distribution functions, g(r), and static structure factors, S(q), from large scale molecular dynamics (MD) simulations. Our simulations consist of 27,648 nuclei modeled classically in a periodically bounded cube. With differing thermal energy and nucleus identity, lattice defects are present with non-constant frequency. This is quantified by a radial distribution function, g(r), which models the probability of finding another nucleus any distance "r" away. This function allows for a quick order $\sim N^2$ calculation of the crystal defects. Discrete inter-ion distances of g(r) with large magnitude correspond to permutations of the lattice constant, while their delta function resemblance corresponds to the perfection of the crystal. S(q) is another metric used to quantify the structure of the crystal lattice. We perform this calculation in two ways, the first by Fourier transforming g(r) and the second by scattering each q vector over the crystal. The first allows the calculation of high-q values, giving a macroscopic understanding of the system. The second, while computationally intensive, yields a better resolution, especially at low-q. From s(q) we can calculate the thermal and electrical conductivity of neutron star crust. This information is crucial in understanding neutron star cooling as well as interpretation of other observables.

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