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Neutron rich matter, neutron stars, and their crusts

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Neutron rich matter can be studied with an extraordinary variety of new tools from radioactive beam accelerators to multi-messenger astronomical observatories. We describe the dense matter in neutron star crusts with large-scale molecular dynamics simulations. We present results for how white dwarf and neutron stars freeze and for many properties of the resulting solid stars including thermal conductivity, shear viscosity, and breaking stress. We use these results to predict electromagnetic, neutrino, and gravitational wave radiations of neutron stars.