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MD Simulations of the Breaking Strain of Coulomb Crystals in Neutron Stars: Star mountains and gravitational waves[1] CHARLES HOROWITZ, Indiana University, JOE HUGHTO, ANDRE SCHNEIDER, DON BERRY — Neutron stars — collapses stars half again as massive as the sun but with a 10-kilometer radius — have solid crusts made of dense coulomb crystals. We perform large-scale molecular dynamic simulations of the breaking strain (strength) of this crust including the effects of impurities, defects, and grain boundaries. We find neutron star crust to be the strongest material known, with a breaking stress 10 billion times stronger than steel [1]. This is because of the high density, high pressure, and the long-range nature of the coulomb interactions where each ion interacts with thousands of its neighbors. The crust can support massive mountains that, on a rapidly rotating neutron star, can radiate detectable gravitational waves. These oscillations of space and time, predicted by Einstein almost 100 years ago, should be detected in the next few years.

[1] C. J. Horowitz and Kai Kadau, Phys. Rev. Letters 102, 191102 (2009).

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