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The neutron star crust: Elasticity, breaking strength, durability and enhancement of the thermonuclear reaction rates

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In this talk I briefly review material properties of the neutron star crust and the plasma screening effects on the nuclear reaction rates. I start from elastic properties. In particular, I demonstrate that for pure Coulomb crystals the elasticity tensor has additional symmetry, which do not depend on the actual crystalline structure and composition. As a particular result of this symmetry, the effective (Voigh averaged) shear modulus of the polycrystalline matter can be derived from the lattice (Madelung) energy. It leads to universal upper limit for the effective shear modulus of polycrystalline or disordered neutron star crust. At the second part of the talk, I discuss current constraints on the maximal elastic deformation of the neutron star crust, crust durability at the maximal deformations and possibility of the plastic motions. The final part of the talk is devoted to plasma screening enhancement of the nuclear reaction rates, focusing attention on the requirement of the consistency with the detailed balance principle.

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