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## Inhomogeneous structures of neutron star crust and mechanical properties

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We investigate inhomogeneous structures and properties of low-density nuclear matter by a relativistic mean-field approach with a fully three-dimensional geometry [1]. By avoiding usage of Wigner-Seitz approximation, we can discuss a priori the structure of matter.

We show that nuclear droplets form a body-centered-cubic (bcc) lattice at lower densities. With increasing density, it changes to a face-centered-cubic (fcc) lattice before nuclear shapes change from spherical droplets to cylindrical rods [2]. The conventional studies predict only the appearance of bcc lattice which minimizes the Coulomb energy. On the other hand, our calculation indicates that the change of the size and shape of droplet affects the lattice structure.

As an application of our new framework, we calculate some parameters of mechanical strength of matter, such as shear modulus. Here, we do not use any simplification but directly obtain the curvature of the energy versus shear deformation. We compare our results with that of analytic calculation.

[1] M. Okamoto, et al, Phys. Lett. B 713, 284 (2012)

[2] M. Okamoto, et al, Phys. Rev. C 88, 025801 (2013)

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