Contribution ID: **224** Type: **Oral report**

Thermodynamically consistent equation of state for an accreted neutron star crust

We study equation of state (EOS) of an accreting neutron star crust. Usually, such EOS is obtained assuming (implicitly) that the free (unbound) neutrons and nuclei in the inner crust move together. We argue, that this assumption violates the condition $\mu_n^\infty = \mathrm{const}$, required for hydrostatic (and diffusion) equilibrium of unbound neutrons (μ_n^∞ is the redshifted neutron chemical potential). We construct a new EOS respecting this condition, working in the compressible liquid-drop approximation. We demonstrate that it is close to the catalyzed EOS in most part of the inner crust, being very different from EOSs of accreted crust discussed in the literature. In particular, the pressure at the outer-inner crust interface does not coincide with the neutron drip pressure, usually calculated in the literature, and is determined by hydrostatic (and diffusion) equilibrium conditions within the star. We also find an instability at the bottom of fully accreted crust that transforms nuclei into homogeneous nuclear matter. It guarantees that the structure of fully accreted crust remains self-similar during accretion.

Authors: Dr GUSAKOV, Mikhail (Ioffe Institute); CHUGUNOV, Andrey (Ioffe Institute)

Presenter: Dr GUSAKOV, Mikhail (Ioffe Institute)

Session Classification: Will not participate

Track Classification: Section 5. Neutrino physics and astrophysics.