

Crust of accreting neutron stars

Monday, 27 February 2023 15:20 (30 minutes)

The talk presents the results of a series of works [1-6] on modeling the outer layers (crust) of neutron stars in close binary systems with a low-mass companion star. The matter of the crust consists of atomic nuclei immersed in a background of degenerate electrons and, in the inner parts of the crust, neutrons. Due to accretion, the original crust is replaced by the accreted matter. The talk discusses the processes occurring in the crust of a neutron star during accretion. It is shown that the redistribution of neutrons in the inner crust, which is due to diffusion near the border of the outer and inner crust and due to neutron superfluidity in the rest of the inner crust, plays a major role in the formation of the crust composition. This effect was not taken into account in previous models, which have been developing for about 40 years. It radically changes the chains of nuclear reactions and the composition of the crust. In particular, the heating caused by nuclear reactions is several times less than previously thought. This is important for the interpretation of observations of the thermal radiation of accreting neutron stars during periods when accretion on the neutron star stops. This work was supported by Russian Science Foundation [Grant No. 22-12-00048]

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- [2] M.E. Gusakov & A.I. Chugunov, Phys. Rev. Lett. 124, 191101 (2020).
- [3] M.E. Gusakov & A.I. Chugunov, Phys. Rev. D, 103, L101301 (2021).
- [4] M.E. Gusakov, E.M. Kantor & A.I. Chugunov, Phys. Rev. D, 104, L081301 (2021).
- [5] N.N. Shchechilin, M.E. Gusakov & A.I. Chugunov, MNRAS, 507, 3860 (2021).
- [6] N.N. Shchechilin, M.E. Gusakov & A.I. Chugunov, MNRAS, 515, L6 (2022).

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