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NUCLEOSYNTHESIS IN A LOW-MASS NEUTRON STAR CRUST. STRIPPING MODEL.

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The lanthanides traces discovery in the kilonova spectra after recording a gamma-ray burst and gravitational waves [1] confirmed theoretical scenarios for the development of the r-process [2], associated with the neutron stars merger at the end of a close binary system evolution. After successful r-process simulation that occurs as a result of the neutron stars merger and observing these events, it became clear that this scenario is crucial for the heaviest nuclei formation. However, the neutron stars evolution in close binary systems strongly depends on their masses. With a large neutron stars masses difference, a stripping scenario is implemented instead of merging [3], which, in particular, has different heavy elements nucleosynthesis path [4,5]. In this work the nucleosynthesis in the low-mass neutron star crust, which loses mass due to accretion onto a larger companion and explodes upon reaching a hydrodynamically unstable configuration [3] is discussed. It is shown that in the stripping scenario the exploded residue substance expands and, while its density is high, new elements nucleosynthesis occurs. In the inner crust it originates mainly due to the r-process with characteristic values of electrons to baryons initial ratio $Ye<0.3$. Nucleosynthesis in the outer crust in the scenario under consideration occurs mainly due to explosive nucleosynthesis with a sharp increase in temperature caused by a shock wave. Various decompression options for subnuclear density matter in the inner crust, preceding nucleosynthesis and forming the initial seed nuclei, are considered. The amount of heavy elements formed in a neutron star crust is $M \sim 0.041 M_\Theta$, which is at least an order of magnitude greater than the yield of heavy elements in the close masses neutron stars mergering scenario [6].
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Section

Neutrino physics and nuclear astrophysics

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