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Investigating the possible existence of hyper-heavy nuclei in a neutron-star environment

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The synthesis of hyper-heavy elements is investigated under conditions simulating neutron star environment. The constrained molecular dynamics approach is used to simulate low energy collisions of extremely n-rich nuclei. A new type of the fusion barrier due to a neutron wind is observed when the effect of neutron star environment (screening of Coulomb interaction) is introduced implicitly. When introducing also a background of surrounding nuclei, the nuclear fusion becomes possible down to temperatures of 10^8 K and synthesis of extremely heavy and n-rich nuclei appears feasible. A possible existence of hyper-heavy nuclei in a neutron star environment could provide a mechanism of extra coherent neutrino scattering or an additional mechanism, resulting in x-ray burst or a gravitational wave signal and, thus, becoming another crucial process adding new information to the suggested models on neutron star evolution.

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