Atomic Nuclei Formation as a Result of the Nuclear Matter Disintegration

Maslyuk V., Parlag O., Marinetc T., Lendyel O., Romanyuk M.

Institute of Electron Physics, Uzhhorod, Ukraine

The well known theory of nucleosynthes is based on the so-called "snowball" approximation, when the synthesis of atomic nuclei are coursed by the series of elementary particles interactions of the initial light nucleus (H, He, Li, B, Be) or more heavy nuclei with the intense beams of electrons, protons, neutrons or alpha particles accelerated in cosmic's strong electromagnetic fields [1-3]. This approach is very useful for explanation the origin of the light, middle and medium-heavy nuclei during r-, s-, p- processes but other approach can be proposed to explain the formation of heavy or superheavy atomic nuclei.

In this report we present the theory based on the concept of the nuclear matter disintegration into atomic nuclei. This theory based on fact that under the supernova- 2 or neutron stars explosion when the nuclear matter densities reached up to $r \sim (10^{-2} - 2)\, r_o$, where $r_o \approx 0.15$ fm^{-3} and temperature, T, to 0.5-10 MeV [3] and the exotic nuclear matter can be formed and their further disintegration may also cause the formation of nuclei of well-known chemical elements. We present the results of first-principle calculations within the proposed theoretical approach [4] of the mass/charge multifragments for initial nuclear matter with an arbitrary A and Z values and ratios. The theory based on investigation of the thermodynamic ordering of the post- fission fragments ensemble for nuclear temperature T and pressure, P. Under calculations we obtain the two stage of nuclear matter disintegration: for great nuclear matter segments (A>>10E10) – symmetric and non structural fission; for intermediate segments (A~1000) – the fine structure and atomic nuclei realisation. The reasons for the presence of uranium/thorium natural series is also discussed.

The authors are grateful to E.Skakun for initiation this work and V.Yu. Denisov for fruitful discussions.

Key words: *Nuclear matter, disintegration, clustering, fragments, magic numbers, atomic nuclei*

[1] Z. Fülöp Zs., Z.Elekes: (http://www.eolss.net/outlinecomponents/Radiochemistry -Nuclear-Chemistry.aspx) (2008)
[2] G. Wallerstein, et al., Reviews of Modern Physics. 1997. – Vol. 69. – P. 995 – 1084
[3] M. Arnould, S. Goriely. Physics Reports . –2003. – Vol. 384. – P. 1. – 84
[4] V.Maslyuk V. et al. – JMP, 2013, 4, 1555-1562