SYNTHESIS OF MAGNETIZED NUCLEI AT THE ZEEMAN REGIME

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Synthesis of ultramagnetized atomic nuclei relevant for supernovae, neutron star mergers, magnetar crusts and heavy-ion collisions is analyzed. Nuclear magnetic reactivity of Zeeman type is shown to dominate for field intensities below ten teratesla. Respective linear magnetic response is given as a combined reactivity of valent nucleons, can be described in terms of nuclear magnetic susceptibility, see Fig. 1, and enhances binding energy for open shell nuclei [1]. For magic nuclei with closed shells the binding energy effectively decreases because of additional pressure induced by an interaction of free nucleon gas with a field. As a result, composition of atomic nuclei created in ultramagnetized matter depends on a field strength. Magnetic field effects in nuclear structure result in an enhancement of nucleosynthesis products of smaller mass numbers for iron group nuclides. In particular, growing of titanium portion at field strength of _1 teratesla is favorably compared to direct observational data of supernova remnants, see Fig. 2, and implies an excess of major titanium isotope in galactic chemical composition.

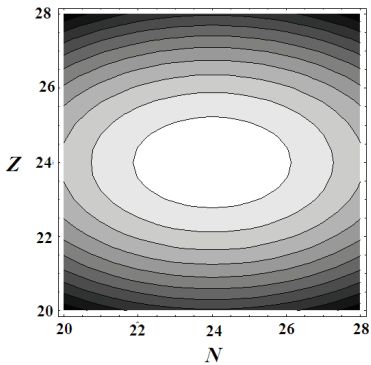

Fig. 1. Contour plot for nuclear magnetic susceptibility versus number of protons Z and neutrons N in a case of $1f_{7/2}$ shell, i.e., the iron shell closure.

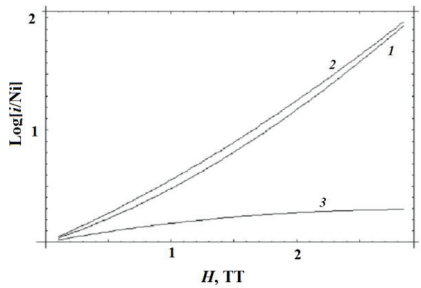

Fig. 2. Magnetic field dependence of yield ratio $[i_i/Ni]$ of ^{56}Ni and ^{44}Ti - 1, ^{48}Cr -2, and ^{60}Zn - 3.

1. V.N.Kondratyev // Phys. Lett. B 2018. V.782. P.167.