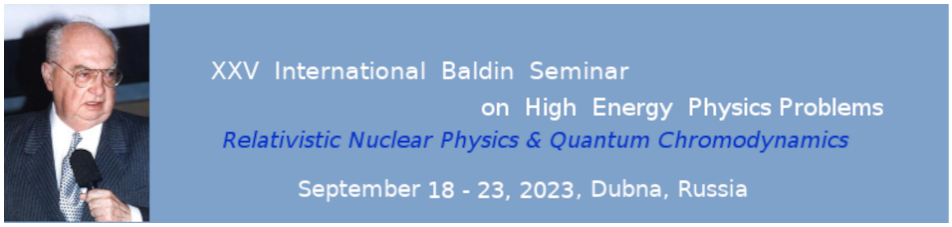

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Structure and synthesis of magnetized heavy nuclei

Friday, 22 September 2023 15:10 (20 minutes)

Nucleosynthesis at large magnetic induction relevant for core-collapse supernovae, and neutron star mergers is considered. For respective magnetic fields of a strength up to ten teratesla atomic nuclei exhibit linear magnetic response due to the Zeeman effect. Such nuclear reactivity can be described in terms of magnetic susceptibility [1]. Susceptibility maxima correspond to half-filled shells. The neutron component rises linearly with increasing shell angular momentum, while the contribution of protons grows quadratically due to considerable income from orbital magnetization. For a case j = l + 1/2 the proton contribution makes tens of nuclear magnetons and exceeds significantly the neutron values which give several units. In a case j = l –1/2 the proton component is almost zero up to g-shell. Respectively, a noticeable increase in the generation of corresponding explosive nucleosynthetic products with antimagic numbers is predicted for nuclei at charge freezing conditions. In the iron group region new seeds are created also for the r-process. In particular, the magnetic enhancement of the volume of 44Ti isotopes is consistent with results from observations and indicates the substantial increase in the abundance of the main titanium isotope (48Ti) in the Galaxy's chemical composition. Magnetic effects are proved to result in a shift of the r-process path towards smaller mass numbers, and an increase in the volume of low mass nuclides in peaks of the r-process nuclei..
1. V.N. Kondratyev // Universe, 7 (2021) 487

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