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Footprints of Non-Inflationary Cosmology in Programs OLIMPIA and Synthesis of Heavy Elements

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Abstract. In this work we are going to apply one of main ideas of "Non-Inflationary Cosmology", established by author as an alternative theory of cosmology – the analogue of the phenomenon of 6-photonic capture of Higgs bosons in Bose-Einstein condensate in the early Universe – as a possible scenario for the implementation and further possible development of two Russian programs "OLIMPIA" and "Synthesis of heavy elements". Offered by us and thoroughly discussed phenomenon of "the cold trapping of baryons within 6-photonic potential well" may be additional or even possible alternative mechanism to the well-known "mechanism of cold synthesis of nuclei".

1. Introduction

For more spacious perception of this paper, it may be appropriate to start from the manifestation of main ideas and hypotheses, new phenomena and processes of alternative theory of cosmology, called by author as Non-Inflationary Cosmology (NIC). The basics of theoretical disclosures and corresponding investigations of NIC are: 1) The original phenomenon of Global hierarchy of Bose-Einstein statistics (BES) over the Fermi-Dirac one (FDS), which has been realized in the earliest Universe and continued till Matter Era (ME). 2) The ordinary global process of the Phase-transition process from BES to FDS, which has initiated the phenomenon Cosmological Small-Bang (CSB), and in turn gave birth to Strong Shock wave (SSW) in ME. 3) The phenomenon of Planck constant's time-evolution has been postulated as an alternative mechanism aiming at explanation of Hubble's Law instead of Doppler Effect. 4) The new cosmological scales (NCS), which turns out to be essentially differ from the Planck scales, has been revealed in ME as a cosmological mission of Higgs boson. Based on these predictions and further assumptions one may state that the cornerstone of NIC is the hypothesis about hegemony of BES over FDS and generation of Bose-Einstein Condensate (BEC) in the starting ME, guaranteeing thus the accumulation of galactic scales masses inside configuration in the state of BEC [1]. Physically it is obvious that the CSB phenomenon within galaxy (one called it as a "small explosion", to distinguish from the Big-Bang) might be the consequence of sudden emergence of Pauli Excursion Principle, enforcing the sharp and enormous change in pressure. Thus, the theory of NIC disclosed another original phenomenon too – the Induced Gravitational Collapse – the straight result of the gravitational collapse, enforced by the CSB and SSW phenomena joint action. If so, then it is obvious, that straight result of these phenomena

might guarantee the generation of Super Massive Black Hole (SMBH) in the core of large-scale Bose-configuration. This disclosure is the first advance of NIC, revealing the major component in galaxy's realistic model [2,3]. The NIC's next original disclosure was the hypothesis about the Phenomenon of Planck constant's time-evolution, which together with phenomenon of 6-photonic capture of Higgs bosons in BEC have constructed CNS [4]. Based on newly disclosed CNS, the theory of NIC has advanced in explaining the energetic resources of galaxy, especially, they helped to re-estimate the earlier theoretical calculations based on Planck scales [5], and now already are consistent with observational data [3,7]. The NIC explains also the morphological types of galaxies, as well as their characteristic parameters, especially confirms the observational data on mass correlations between galaxies' SMBH and disk [6]. The theory of NIC explains also the recently observed phenomenon – the unique character of disk-form galaxies' rotation [7].

The verifications of cosmological and astrophysical observational findings, based on theoretical investigations, outlined partly in [1-7,10], are so reliable and encouraging that in this work we are confidently trying to make a heuristic generalization, dictated mainly by the Nature's uniformity in extra-small and extra-large scales. As a prominent task for this assumption, in this work we will apply one of the main ideas and its astrophysical models discovered in the frame of NIC as a schematic scenario for the implementation and, maybe, further possible development of two noticeable Russian programs – "OLIMPIA" [8] and "Synthesis of heavy elements" [9].

2. Data-analyse of "OLIMPIA" based on the theoretical outcomes of NIC

The registrations of nuclei within galactic cosmic rays [8], especially with atomic numbers in the range of $105 < Z < 130$, can essentially confirm the assumption made in the theory of NIC [4], according to which the initial bosons – the Higgs Bosons in the earliest Universe – could have been principally trapped within the potential well, which the Nature has created via counterpart photons in all three orthogonal directions (6-photonic quantum well). Making this assumption, we rely on the belief that if NCS in ME has successfully explained a number of important observational facts these coincidences are not contingency. Vice versa, the theory of NIC requires to use own successes also within Earth-physics, so NIC encourages to check the general nature of 6-photon potential trap also in similar terrestrial experiments. We mean first of all the Russian program "OLIMPIA", considering here the correctness of our perceptions confirmed via additional observations/registrations of possible decays of registered in [8] nuclei. Considering this prediction practically possible, let's ask: may the anticipated high-frequency photons be observed during such an experiment as a result of nuclei's decay? It may be expected that taking into consideration the established phenomenon in NIC – the trapping of Higgs boson inside the 6-photonic potential well – probably one may anticipate the appearance of ejected gamma-quanta as a result of decay of the nuclei in [8]. Bearing in mind this apriority statement, it is necessary to delve into the essence of the other mechanisms of possible decay channels, waiting for the disclosure of additional information on this problem. At the same time one may develop the same physical approach on registration of supposed gamma-quanta rays in the processes of decay of registered in [8] nuclei with various atomic and mass numbers, aiming at creation of proposed gamma quanta's spectrum. Finally, if the expected gamma-quanta actually may be recorded, then the whole physical picture of decay's processes can be easily reconstructed based on their frequency spectrum, taking into consideration the predictions of NIC – trapping baryons or even any isotope inside the 6-photonic potential well of corresponding frequencies of gamma rays.

After all, the following major problem waits for its explanation: How and where have been generated the registered in [8] nuclei? If these nucleons are reached the Earth as part of galactic rays, then how they have been formed? As we assume, there are two physical explanations for the questions posed. First of all, we need to explain could these galactic rays be formed due to

CSB and SSW phenomena. Getting acquainted with [8], we consider the possible astrophysical origin of the galactic jets ensuring the following physical scenario: the joint CSB and SSW phenomena might dramatically increase the concentration in the vicinity of the galactic SMBH. If so, then the particle's Fermi energy might exceed its gravitational potential and no longer the particle could be trapped inside SMBH near its outer surface by the gravitational potential well. So, the particles would be able to erupt outside with relativistic velocities.

The relativistic future of particles within galactic jet can be probably proofed based on author's early paper [10]. Based on results of our earlier investigation on magneto-hydrodynamics of plasma in the crust of a neutron star, one may generalize obtained in paper [10] formulas for kinetic coefficients of plasma, namely for the plasma consisted of Higgs bosons' in the state of BEC (also for other bosons: pairs of baryons-antibaryons and leptons-antileptons, even for other possible bosons). Preliminary, one has revealed the possibility of application of obtained in [10] thermoelectric effect, in principal, for present paper, where the temperature gradient between the spherical layers in the vicinity of SMBH may be conversed directly to electrical field, even extra-strong. These physical judgments guarantee the acceleration of ejected particles till relativistic velocities due to acceleration by this strong electrical field. Refraining from the circumstances, in this paper let's mention only the most obvious phenomenon: the giant temperature gradient might be formed in close vicinity of the SMBH, where the spherical layer of hot plasma generated due to joint action of CSB and SSW phenomena surrounded by the outer layer of cold plasma, maintaining yet in the state of BEC.

3. Possible application of phenomena of NIC of "Synthesis of heavy elements"

We expect that in case of successful application of 6-photonic potential well in the Russian program "OLIMPIA", namely in capture of baryons, further can be tested in the possible scenario of its application also in the possible experiments of the synthesis of heavy elements, where the brilliant ideas of Yu Ts Oganesyan has been already realized [9]. As is known, the double role of $^{48}_{28}Ca$ requests this isotope in the production of many super-heavy elements with $Z \leq 118$, so during last three decades this idea is proposing as a projectile on various transuranium targets. So, if expected gamma-quanta will be disclosed in the process of decay of registered in [8] nuclei, then the phenomenon of "6-photonic capture of baryons" hopefully can play significant role also in the process of synthesis of $^{48}_{28}Ca$. This isotope is seen in Nature very rarely, more than its artificial synthesis is enough expensive, so first of all one recommends the nuclear synthesis of $^{48}_{28}Ca$ via 6-photonic capture of baryons, using as a target quite common and cheap isotope $^{40}_{20}Ca$.

As is known, in electromagnetic interaction can take part only objects with an electric charge, including also neutral ones consisting of charged sub-particles. In this sense, although interaction between separate neutrons and photons is not considered within the framework of quantum electrodynamics, our present offer is a prerequisite for the possible interaction of photons and neutrons in extra-small range of space where the structure of neutrons may be revealed. As is shown, in our offer the spatial size of 6-photonic trap is comparable to the neutron's de-Broglie wavelength (see below), therefore the internal structure of the neutron precisely may be detected.

In this regard, let's clarify why we are equally interested in the future fortune of nuclei registered in the "OLIMPIA"program [8], especially with possibility of their decay. Actually, about 6000 recorded data may reveal an important distribution of frequencies of expected gamma-quanta in the predicted decay of registered in [8] nuclei, which in turn may provide valuable data about possible ranges of gamma-frequencies, where the phenomenon of "6-photonic potential well" may play significant role in capture and trapping not only individual baryons, especially neutrons (!), even $^{48}_{28}Ca$. We believe that this mechanism of gamma-capture may be accepted as "cold gamma-trapping", thus becoming an alternative to the already known mechanism of "cold fusion" mechanism in heavy elements' synthesis. The frequency of gamma-

quanta, generating the potential well for the element (A, Z) within galaxies in ME, reads as $\omega \geq (Zm_p + (A-Z)\, m_n)\, c^2/\hbar_{ME}$, where $\hbar_{ME} \approx 6.06 \times 10^{-27}$ erg $\cdot$ s is the value of Planck constant in ME [4]. Note, that due to the phenomenon of Planck constant's time-evolution [4] $\hbar_{ME}/\hbar \approx 5.75$, where $\hbar$ is the current value. Therefore, the expected registration of gamma-quanta in the process of possible decay of any isotope in [8] may become an indirect proof on the reality of Planck constant's time-evolution phenomenon, accepted in NIC as a main hypothesis. In general case the minimum of potential well must be in order of $U^{ph}_{\min} \geq \alpha\gamma mc^2$, where γ is the relativistic factor, and the coefficient $\alpha \sim 2$ exclude the possibility of quantum tunneling from the 6-photonic potential trap. Being interested mainly with process of synthesis of $^{48}_{28}Ca$ on the base of $^{40}_{20}Ca$, one may accept for the neutrons $\gamma \approx 1$, so $U^{ph}_{\min} \geq 2m_nc^2$ and $\omega^{ph}_{\min} \geq m_nc^2/3\hbar_{ME} \sim 8.3 \times 10^{22}$ s^{-1}. The values of concentration of modern neutrons' beam is not so big to allow more than single neutron within the gamma-quantum well with size about 3.6×10^{-13}cm, corresponding the value of above determined frequency. The above mentioned scales must be changed by the factor $\hbar_{ME}/\hbar \approx 5.75$ for the same scenarion in the ground based experiments. Thus, the gamma-quantum well with size should be about 0.63×10^{-13} cm. At the other hand, the sizes of heavy nuclei also are same order entities 10^{-13} cm, so not only $^{48}_{28}Ca$, but also heavy nuclei (participants of future nuclear reactions) may "rest within potential well for long time", waiting for capture of neutron (it usually needs for long time). So the gamma-quantum potential well may solve this problem effectively: in the theoretically suggested scenario the neutron can remain in the potential well for a sufficient long time till the merging with the core nucleus. So, offered by us and thoroughly discussed here phenomenon of "cold trapping within 6-photonic potential well" may be, in principle, additional or even possible alternative mechanism to the"cold synthesis of nuclei". Finally, the generation of high-energy photons' beam with above-mentioned frequencies is well investigated problem, and may be realized due to the inverse Compton Effect [11]. Let's note that in "Inverse Compton Beams" the following energy values for gamma rays were obtained: LEGS – 2.5 GeV; GRAAL – 6 GeV; LEPS – 8 GeV. At last, we hope that receiving a joint research proposal from the Russian scientific groups [8, 9] we will present additional data on further research and more concrete estimations, even advanced scenario regarding mentioned here primary suggestions. Finally, these theoretical judgments may have twice as indirect proofs: 1) if high-frequency gamma-quanta may be recorded as the final result of the already observed nuclei's possible decay in the "OLIMPIA" program, and 2) if even single event of a neutrons' capture phenomenon may be registered as an experimental pattern in heavy elements' synthesis process. Any confident outcome may become a basis for further consideration of cross-section of such yet non-investigated mechanism, moreover for comparison, in principle, of electromagnetic and strong interactions' channels in suggested heuristic expectations.

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