# The Stellar GASER

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**Abstract:** Here, applying the Scale-Symmetric Theory (SST), we show that the GASER (Gamma Amplifier by Stimulated Emission of Radiation) is characteristic for stars with a mass close to one solar mass. SST shows that in reality the observed neutrino “oscillations” follow from the exchanges of the free neutrinos (they interact gravitationally only) for the neutrinos in the neutrino-antineutrino pairs the Einstein spacetime consists of, and follow from the decays of the unstable tau-neutrinos. Just due to the irreversible processes during the inflation, the neutrino-antineutrino pairs cannot annihilate and neutrinos cannot change their species. Notice as well that there is no reliable experimental data showing that at such a short distance as between the Sun and Earth, two-thirds of electron-neutrinos could change their species. SST shows that there are the exchanges and decays of the neutrinos but their abundance should be much lower than it is assumed in the mainstream cosmology. We must find a different mechanism explaining why we see only about one-third of the electron-neutrinos. Here we show that the solar neutrino problem can be solved via the stellar GASER which is characteristic for stars with a mass close to one solar mass. GASER causes that we observe only about 35.7% electron-neutrinos in comparison with abundance calculated within the Big Bang Nucleosynthesis. The GASER solves as well the lithium problem. The lithium problem should be characteristic for old stars with mass below 0.94 solar mass. The various nuclear transformations in such stars cause that the production of lighter nuclei is not such effective as it is assumed in the Big Bang Nucleosynthesis.

## 1. Introduction

The General Relativity leads to the non-gravitating Higgs field composed of tachyons [1A]. On the other hand, the Scale-Symmetric Theory (SST) shows that the succeeding phase transitions of such Higgs field lead to the different scales of sizes [1A]. Due to the saturation of interactions via the Higgs field and due to the law of conservation of the half-integral spin that is obligatory for all scales, there consequently appear the superluminal binary systems of closed strings (entanglons) responsible for the quantum entanglement, stable neutrinos and neutrino-antineutrino pairs which are the components of the Einstein spacetime (it is the Planck scale), cores of baryons, and the cosmic structures (protoworlds) that evolution leads to the dark matter, dark energy and expanding universes [1A], [1B]. The non-gravitating tachyons have infinitesimal spin so all listed structures have internal helicity (helicities) which distinguishes particles from their antiparticles [1A].

Due to the symmetrical decays of bosons on the equator of the core of baryons, there appears the atom-like structure of baryons described by the Titius-Bode orbits for the nuclear strong interactions [1A].

During the inflation, the liquid-like inflation field (the non-gravitating superluminal Higgs field) transformed partially into the Einstein spacetime [1A]. It means that today the two-component spacetime consists of the superluminal non-gravitating tachyons (the Higgs field) and of the gravitating neutrino-antineutrino pairs (the ground state of the Einstein spacetime).

The spin-1 neutrino-antineutrino pairs are the carriers of the gluons and photons. The difference between the 8 types of gluons and the 1 type of photons does not follow from differences of their carriers (they are the same) but from different interactions of the neutrino-antineutrino pairs with fields having internal helicity (the nuclear strong fields have internal helicity) and with fields which have not internal helicity (the electromagnetic and gravitational fields have not internal helicity) [1A]. This means that on the edges of the nuclear fields there is the gluon←→photon transition. The gluons and photons are the rotational energies of the neutrino-antineutrino pairs.

In reality, the neutrino "oscillations" are the exchanges of the free neutrinos (they interact gravitationally only) for the neutrinos in the neutrino-antineutrino pairs, and the decays of the unstable tau-neutrinos which consist of three different stable neutrinos (they are the electron-neutrino, muon-neutrino and their antiparticles) [1A]. The irreversible processes during the inflation described within SST caused that the neutrino-antineutrino pairs composed of the stable neutrinos cannot annihilate to some quanta of energy and that neutrinos cannot change their species [1A].

The most important phenomenon to explain how the stellar GASER (Gamma Amplifier by Stimulated Emission of Radiation) acts is the internal structure of muons that are produced in the nuclear plasma in centres of stars. SST shows that there is a torus/charge with central condensate composed of confined neutrino-antineutrino pairs [1A]. Moreover, inside the condensate there are the two entangled stable neutrinos that appear in the decays of muons. In the decays of muons, there can appear two free neutrinos or their pair i.e. the carrier of gluons/photons with energy of $E\gamma,g = 35.551$ MeV [1A]. The free neutrinos immediately leave the interior of a star whereas the $E\gamma,g$ quanta, because of their strong and electromagnetic interactions, cannot do it so temperature increases and it can ignite the GASER.

What mass should have a star with acting GASER? SST shows that mass of produced characteristic quanta is directly proportional to mass of star and that for a star with a mass of $f = 24.81$ solar masses (it is the neutron star [1B]), the characteristic quanta have energy about $E_{charact.,max} = 939$ MeV [1B]. It leads to conclusion that acting GASER is characteristic for stars with a mass close to

$$M_{GASER} = f\, E\gamma,g \,/\, E_{charact.,max} = 0.939 \text{ solar masses} \approx \text{Mass of Sun}. \tag{1}$$

Emphasize once more that the GASER is characteristic for the stars with a mass close to one solar mass.

## 2. The stellar GASER

The four-neutrino/fermion/object symmetry, [1A], [1B], [1D], leads to conclusion that the abundance of chemical elements in the Universe should have higher "peaks" for 1, 4, 16, (64→56), 256→208 nucleons. This is consistent with observational facts.

The mean energy released in the transformation of protons into nuclei of helium is $E_{p\text{-}He\text{-}4} = 7.07$ MeV per nucleon. Due to the four-object symmetry, there can appear the groups of the entangled $E_{p\text{-}He\text{-}4}$ quanta composed of 4, 16, 64, 256,…quanta. The quantum entanglement causes that the energies of single groups are sufficiently high to force the more energetic nuclear transformations. It is the stellar gamma amplification by stimulated emission of the entangled quanta $E_{p\text{-}He\text{-}4}$ that next force the various nuclear transformations.

The numbers of nucleons that we must take into account are 1, 4, 16 and 56 (for increasing number of nucleons in atomic nuclei above about 60, the mean binding energy per nucleon decreases so we can neglect such nuclei). The GASER causes that there are the three main channels of nuclear transformations: protons into helium (1 → 4), helium into oxygen (4 → 16), and oxygen into iron (16 → 56).

Cosmology described within SST shows that there is the number-density-of-nucleons symmetry [1B]. It should concern the three main channels also i.e. number of involved nucleons in all channels should be the same.

Assume that inside the Sun the GASER does not act i.e. there are only the transformations of protons into helium. To simplify the calculations, assume that 336 protons transform into 84 nuclei of helium. It means that there are emitted 168 electron-neutrinos.

Now assume that inside the Sun the GASER acts. The 336 (protons) / 3 (channels) = 112 protons transform into 28 nuclei of helium so there are emitted 56 electron-neutrinos. The 28 nuclei of helium (i.e. 112 nucleons) transform into 7 nuclei of oxygen so there are not emitted electron-neutrinos. The 7 nuclei of oxygen (i.e. 112 nucleons; 56 neutrons) transform into 2 nuclei of iron (i.e. there are 60 neutrons) so there are emitted 60 – 56 = 4 electron-neutrinos. We can see that the total number of emitted electron-neutrinos is: 56 + 0 + 4 = 60.

We can see that the GASER causes that the total number of emitted electron-neutrinos is $X = 60 / 168 = 0.3571$ (about 36%) of the number of emitted electron-neutrinos calculated within the Big Bang Nucleosynthesis (BBN).

The GASER solves as well the lithium problem. The lithium problem should be characteristic for old stars with mass below 0.94 solar mass. The various nuclear transformations in such stars cause that the production of lighter nuclei is not such effective as it is assumed in the Big Bang Nucleosynthesis. The ratio of the derived value of the Li abundance on the basis of the Very Large Telescope (VLT) data (it concerns a selection of stars in the globular cluster Messier 54 which is part of the Sagittarius Dwarf Galaxy) (A(Li)) [2] to the derived value on the bases of the WMAP and PLANCK data and the Big Bang Nucleosynthesis (BBN) standard model ($A(Li)_{BBN}$) [5] is $A(Li) / A(Li)_{BBN} \approx 0.3$. The derived value [3] is about a factor of 3 higher than that measured in dwarf stars.

**3. Summary**

Here, applying the Scale-Symmetric Theory (SST), we show that the GASER (Gamma Amplifier by Stimulated Emission of Radiation) is characteristic for stars with a mass close to one solar mass.

SST shows that in reality the observed neutrino "oscillations" follow from the exchanges of the free neutrinos (they interact gravitationally only) for the neutrinos in the neutrino-antineutrino pairs the Einstein spacetime consists of, and follow from the decays of the unstable tau-neutrinos. Just due to the irreversible processes during the inflation, the neutrino-antineutrino pairs cannot annihilate and neutrinos cannot change their species. Notice as well that there is no reliable experimental data showing that at such a short distance as between the

Sun and Earth, two-thirds of electron-neutrinos could change their species. SST shows that there are the exchanges and decays of neutrinos but their abundance should be much lower than it is assumed in the mainstream cosmology. We must find a different mechanism explaining why we see only about one-third of the electron-neutrinos.

Here we show that the solar neutrino problem can be solved via the stellar GASER which is characteristic for stars with a mass close to one solar mass. GASER causes that we observe only about 35.7% electron-neutrinos in comparison with abundance calculated within the Big Bang Nucleosynthesis. Of course, instead the inverse beta decay: $p + e^+ \rightarrow n + \nu_e$, there can dominate following processes

$$p + \pi^o \rightarrow n + \pi^+ \rightarrow n + e^+ + \nu_e\ \nu_{\mu,anti}\ \nu_\mu\ (\equiv \nu_\tau) \rightarrow n + e^+ + \nu_e + \nu_{\mu,anti} + \nu_\mu\ . \quad (2)$$

On the assumption that we can neglect the tau-neutrinos, the upper limit for abundance of all solar neutrinos in comparison to the abundance predicted within the mainstream solar nucleosynthesis is $3 \cdot 35.7 \approx 107\%$ i.e. is a little shifted. But we know that there as well appear the tau-neutrinos so the real abundance is lower than the upper limit.

The GASER solves as well the lithium problem. The lithium problem should be characteristic for old stars with mass below 0.94 solar mass. The various nuclear transformations in such stars cause that the production of lighter nuclei is not such effective as it is assumed in the Big Bang Nucleosynthesis.

**References**

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