Helium problem and CNO problem: two anomalies explained by dark fusion

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February 3, 2020

Abstract

Helium problem means that there are stars with very low Helium content in the very early Universe. The predicted content is 3 times higher. This suggests that the view about Big Bang Nucleosynthesis (BBN) is not quite correct. If the BBN abundance is one third from the accepted, there must be an additional mechanism producing He and it cannot be stellar fusion.

CNO problem means that unexpectedly high C, N, and O contents in the atmosphere of one of the oldest and most elementally depleted stars known - a "primitive star" scientists call J0815+4729 representing. This finding obviously challenges the views about stellar nuclear fusion since the star in question is very young star and the element abundances should be near to those produced in BBN. Note however that the elemental abundances are associated with atmosphere of the star. Could there be a variant of fusion process taking place outside the stellar cores? TGD suggests dark cold fusion as this kind of process and the proposal formulated more precisely in the sequel suggests a solution of both He and CNO problems.

Helium problem [E3] (http://tinyurl.com/r3xqebt) means that there are stars with very low Helium content in the very early Universe. The predicted content is 3 times higher. This suggests that the view about Big Bang Nucleosynthesis (BBN) is not quite correct. If the BBN abundance is one third from the accepted, there must be an additional mechanism producing He and it cannot be stellar fusion.

The popular article "*Astronomers detect very unusual chemical composition in ancient star's atmosphere*" (http://tinyurl.com/rhsqk8g tells about unexpectedly high C, N, and O contents in the atmosphere of one of the oldest and most elementally depleted stars known - a "primitive star" scientists call J0815+4729 representing. For a more technical representation see the original article [E2] (http://tinyurl.com/u3rrnn9). This finding obviously challenges the views about stellar nuclear fusion since the star in question is very young star and the element abundances should be near to those produced in BBN. Note however that the elemental abundances are associated with atmosphere of the star. Could there be a variant of fusion process taking place outside the stellar cores?

TGD predicts new nuclear physics, which could explain these anomalies. I have already earlier considered explanation of various anomalies [L4] (http://tinyurl.com/slyo8p3). These two anomalies are only additional items in a long list.

> "Cold fusion" researchers, originally labelled as swindlers and crackpots, are nowadays regarded respectable scientists. Genuine cold fusion not allowed by standard nuclear physics is not in question and "low energy nuclear reactions" (LENR) is a politically more correct expression. "Nuclear transmutation" is also a term used.
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> In TGD framework "cold fusion" is replaced by dark fusion involving generation of dark proton strings (some protons can transform to neutrons) having interpretation as dark nuclei [L3, L2] (http://tinyurl.com/y7u5v7j4 and http://tinyurl.com/y2v3qn6a). They would have non-standard value $h_{eff} = n \times h_0$ of effective Planck constant and would be formed of protons directly because of thei large Compton length. Dark nuclei can transform to ordinary nuclei. This would give rise to "cold fusion".

2. Dark fusion would precede ordinary nuclear fusion occurring in the cores of stars and contribute to the nuclear abundances and modify the predictions of bigbang fusion and stellar fusion and explain a long list of astrophysics anomalies. Also the theory of ordinary hot fusion would be changed and solve the 10 year old anomaly related to metallic abundances identified by Asplund et al [E1, E4] [L5]. The fusion reactions could occur via a creation of dark nuclei - rather than via tunnelling - and the dark nuclei would read and reaction products would tranform back to ordinary nuclei.

3. The model change the view about the prestellar period of stars. "Cold fusion" in TGD sense would serve as a "warm-up band" and the energy liberated as dark nuclei generated from protons transform to ordinary nuclei would transform to ordinary nuclei and gradually heat the matter so that ordinary nuclear physics enters in the game and stellar core is born. The dark fusion generates nuclei with all nuclear weights.

How could understand the two anomalies in terms of dark fusion? Consider first the Helium content of the early Universe.

1. Light elements D, T, He, Be would have been produced during by Big Bang Nucleosynthesis (BBN) during first few minutes (`http://tinyurl.com/qczc8ty` and `http://tinyurl.com/vr7ctaq`). The production ceased as the temperature became too low for nuclear reactions to occur. Nuclear reactions started again in the stellar cores and according to the prevailing wisdom produced the heavier elements.

   The relative abundance of Helium (which cannot be produced in stellar interiors), estimated to be about 25 per cent, would be determined by BBN. He abundance depends on the density protons and the exact value of Hubble constant determining the expansion rate. It is possible to vary these parameters so that the observed value of He abundance (difficult to observe, for instance for Sun it is not known) is taken as the input.

2. Giving up entire Big Bang theory (BB) is not a plausible idea. One can modify the parameters of BB to obtain a lower amount of Helium. This however requires an additional fusion mechanism, which must have been at work outside stellar cores and produced higher He content outside stars after BB.

   The contribution of dark fusion tends to increase the abundances determined by BBN. The amount of Helium produced in BBN should be considerably lower than believed and Helium poor stars would provide a better upper bound for He produced in BB. The amount of He would increase at least by a factor 3 by the production during pre-stellar periods by dark fusion. This implies that the density fraction of baryonic matter - few per cent in standard picture - would have been even lower. This does not seem to be a problem.

Dark fusion outside stellar interiors could also explain the anomalously high CNO content in the atmospheres of stars as being due to the prestellar period and have nothing to do with the physics in the stellar cores. Exceptionally high C, N, and O abundances would be produced by dark fusion outside stellar interiors - such as stellar atmospheres - and relate to the warm-up period.

What is intriguing C, N, and O playing a central role in biology are involved. There is evidence for bio-fusion [C1, C2] - not taken seriously by the mainstream - and since Pollack effect [L1] generating dark nuclei at room temperature in presence of say solar radiation, is central in TGD based quantum biology, dark fusion producing ordinary nuclei in living matter is predicted [L3].

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