Evidence of the big fix?

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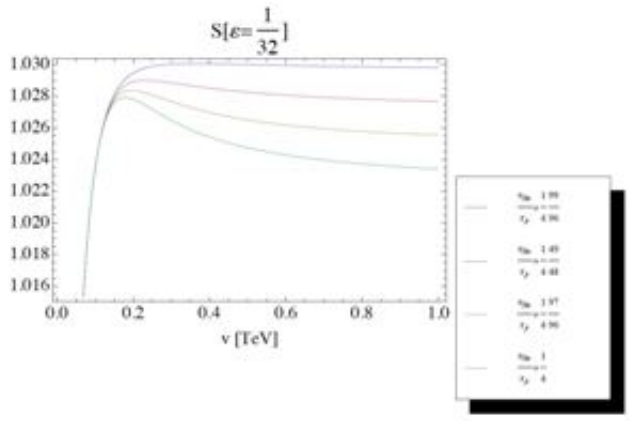

Here the current quark masses, the gauge couplings, and the Higgs self-coupling are fixed. The different lines correspond to the different life times of a Helium nucleus. Credit: Dr. Yuta Hamada, Dr. Hikaru Kawai and Dr. Kiyoharu Kawana at Kyoto University

The theory of wormholes and multiverse suggests that the parameters of the Standard Model are fixed such that the total entropy at the late stage of the universe is maximized. We consider the radiation of the universe as a function of the Higgs expectation value and show that it reaches maximum around the observed value 246 GeV. It turns out that the existence of the atomic nuclei plays a crucial role to maximize the radiation.

There are many open questions that the Standard Model cannot answer. One of them is the smallness of the Higgs expectation value vh

compared with the Planck scale. In their latest work, Dr Yuta Hamada, Dr Hikaru Kawai and Dr Kiyoharu Kawana at Kyoto University, consider the radiation S of the universe at the late stage as a function of vh, and they show that S reaches its maximum around the observed value vh = 246 GeV.

"If we demand that S should be maximized, this conclusion can be the explanation to the above question. The main contribution to S comes from the decay of baryons. We assume that baryons are produced at the early universe by the Sphaleron process. Because some of baryons exist as atomic nuclei, we must consider the effect caused by the binding energy of atomic nuclei and the possibility that a pion produced by the decay of a nucleon in a helium nucleus is scattered by the remaining nucleons and loses its energy", says Dr Kawana.

The figure above shows the result in which case the current quark masses, the gauge couplings, and the Higgs self-coupling are fixed. ε is the dimensionless parameter that represents the decrease of the radiation due to the pion scattering, and τp (τHe) is the life time of a proton (Helium nucleus). One can see that S becomes maximum around vh = 246 GeV. This conclusion may be one of the evidences of the Big Fix that the parameters in the Standard Model are naturally fixed so that the radiation of the universe becomes maximum.

More information: The paper appears in *International Journal of Modern Physics A*, Vol. 29, 1450099 (2014).

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