

Astrophysical constraints to axion-photon coupling

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We revise the astrophysical bound to the axion-photon coupling, as obtained by comparing $R=N_{\text{HB}}/N_{\text{RGB}}$ (1) measured in a sample of 39 Galactic Globular Clusters with up-to-date theoretical predictions. First results, already published in a PRL paper in 2014, show that the derived bound significantly depends on the assumed He mass fraction. To remove this degeneracy, accurate measurements of the early He content of our Galaxy are required.

More recently, we have developed a new and more accurate method to calculate the theoretical R , which makes use of synthetic Colour-Magnitude diagrams to be directly compared to the observed (real) diagrams. It required the calculation of a few hundreds evolutionary sequences of stellar models with the typical mass of the evolved stars in Globular Clusters, under various assumptions for the original He content and mass loss history. Uncertainties in the relevant nuclear reaction rates, as well as those related to the development of convection during the core He burning phase, have been carefully considered and combined by means of a Monte Carlo procedure. Methods and results of this new analysis will be here presented.

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