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Calculating the Standard Model parameters: the cosmological constant, the Higgs mass, and the masses and mixing matrices of quarks and leptons

Abstract

I will discuss the computation of the cosmological constant, the Higgs mass and the masses and mixing matrices of quarks and leptons based on the new approach to quantum gravity, called “gravitization of quantum theory."

First, I will provide a background to this approach and then discuss the computation of the cosmological constant in more detail, and finally, generalize that computation for the case of the observed Higgs mass as well as the masses and mixing matrices of quarks and leptons. Surprisingly enough, the observed masses of quarks and charged leptons are controlled by a new scale of 7 MeV (called the Bjorken-Zeldovich scale) and the normal hierarchy of neutrino masses is controlled by the observed cosmological constant scale. Also, the CKM and PMNS mixing matrices have similar structures controlled by these respective scales, even though they are numerically very different. There are 3 generations in this approach, but there is also a dual Standard Model characterized by “fuzzy” degrees of freedom that do not commute with the visible Standard Model degrees of freedom. I will comment on how all that relates to the problems of dark matter and dark energy and I will also discuss a “smoking gun" experiment that distinguishes this new approach to the fundamental question of how to formulate a quantum theory of spacetime and matter.