Contribution ID: **23** Type: **not specified**

Cosmological selection of a small weak scale from large vacuum energy: a minimal approach

Thursday 29 May 2025 17:20 (20 minutes)

We present a minimal cosmological solution to the hierarchy problem. Our model consists of a light pseudoscalar and an extra Higgs doublet in addition to the Standard Model field content. We consider a landscape of vacua with varying values of the electroweak vacuum expectation value (VEV). The vacuum energy in our model peaks in a region of the landscape where the electroweak VEV is non-zero and much smaller than the cutoff. During inflation, due to exponential expansion, such regions of the landscape with maximal vacuum energy dominate the universe in volume, thus explaining the observed smallness of the electroweak scale with respect to the cutoff. The pseudoscalar potential in our model is that of a completely generic pseudogoldstone boson—not requiring the clockwork mechanism—and its field value never exceeds its decay constant or the Planck scale. Our mechanism is robust to the variation of other model parameters in the landscape as the electroweak VEV is varied. It also predicts a precise and falsifiable relationship between the masses and couplings of the different Higgs boson mass-eigenstates. Moreover, the pseudoscalar in our model can account for the observed dark matter relic density.

Primary author: CHATTOPADHYAY, Susobhan (Tata Institute of Fundamental Research (TIFR), Mumbai)

Co-authors: CHATTOPADHYAY, Dibya S. (Oklahoma State University); GUPTA, Rick S. (Tata Institute of Fundamental Research (TIFR), Mumbai)

Presenter: CHATTOPADHYAY, Susobhan (Tata Institute of Fundamental Research (TIFR), Mumbai)

Session Classification: Model Building