# JOINT TUFTS/MIT COSMOLOGY SEMINAR

# *Dynamical Criticality on the String Landscape and Higgs Metastability*


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A striking feature of our universe is its near criticality. The cosmological constant and weak hierarchy problems, as well as the metastability of the electroweak vacuum, can all be understood as problems of criticality. This suggests a statistical physics approach, based on the landscape of string theory. In this talk I will present a dynamical selection mechanism for hospitable vacua based on search optimization. Instead of focusing on late-time, stationary probability distributions for the different vacua, we will be interested in the approach to equilibrium. I will argue this imposes a strong selection pressure among hospitable vacua, favoring those that lie in regions where the search algorithm is efficient. The proposed mechanism makes concrete and testable predictions. Firstly, it favors vacua residing in regions of the landscape with funnel-like topography, akin to the energy landscape of naturally-occurring proteins. Secondly, it favors regions of the landscape that are tuned at dynamical criticality, with vacua having an average lifetime of order the de Sitter Page time. Thus the predicted lifetime of our universe is of order its Page time, $\sim 10^{130}$ years, which is compatible with the Standard Model estimate for electroweak metastability. Relatedly, the supersymmetry breaking scale should be high, at least $10^{10}$ GeV. The present framework suggests a correspondence between the near-criticality of our universe and dynamical critical phenomena on the string landscape.


## Tuesday, February 11, 2020, 2:30 pm

## Cosman Seminar Room

## Center for Theoretical Physics

## Building 6C, Room 6C-442

## Massachusetts Institute of Technology

Refreshments at 2:00 in the same room