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The axidental Universe

Thursday 25 June 2020 17:00 (1 hour)

Zoom meeting: https://cern.zoom.us/j/7930190483 (password: see email)

Format: 40 minutes talk + 20 min discussion

Virtual Axion Institute: The discussion on this talk can be continued in Matthew's virtual guest office. https://mattermost.web.cern.ch/axions/channels/matthew-kleban

Abstract: Theories of N axion fields with random potentials have a number of distinct meta-stable minima that scales super-exponentially with N. This makes large N axion theories extremely complex "landscapes"that are could provide a solution to the cosmological constant problem. Despite this extraordinary complexity, novel techniques exist that make these theories analytically and computationally tractable. For N˜100s and with Planckian or GUT/string energy scales and random parameters, there are many minima with vacuum energy consistent with observed dark energy (as well as very many more with larger positive or negative values). These minima are long-lived, and decay via thin-wall Coleman de Luccia phase transitions only to ˜N nearby neighbors. This landscape supports a variety of types of slow-roll inflation, and tunneling can be followed by inflation of roughly quadratic type, with density perturbations that have amplitude ˜10^{-5} in this same random parameter regime. They naturally contain one or more light fields that can solve the strong CP problem and serve as fuzzy or QCD axion dark matter. The minimal anthropic requirement that structure forms somewhere/sometime singles out cosmological histories that tunnel and then undergo ˜60 efolds of inflation post-tunneling. Hence, a theory of ˜100s axions, without model building and with only GUT-scale random parameters, naturally produces large universes with histories very much like that of our own, including a big bang (tunneling), slow-roll inflation, dark matter, and dark energy.

Presenter: KLEBAN, Matthew (New York University)

Session Classification: Naturalness