Séminaire de physique des particules et de cosmologie

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Crunching Away the Cosmological Constant Problem

Michael Geller

Tel Aviv University

We propose a novel explanation for the smallness of the observed cosmological constant (CC). Regions of space with a large CC are short lived and are dynamically driven to crunch soon after the end of inflation. Conversely, regions with a small CC are metastable and long lived and are the only ones to survive until late times. While the mechanism assumes many domains with different CC values, it does not result in eternal inflation nor does it require a long period of inflation to populate them. We present a concrete dynamical model, based on a super-cooled first order phase transition in a hidden conformal sector that may successfully implement such a crunching mechanism. We find that the mechanism can only solve the CC problem up to the weak scale, above which new physics, such as supersymmetry, is needed to solve the CC problem all the way to the UV cutoff scale. The absence of experimental evidence for such new physics already implies a mild little hierarchy problem for the CC. Curiously, in this approach, the weak scale arises as the geometric mean of the temperature in our universe today and the Planck scale, hinting on a new "CC miracle", motivating new physics at the weak scale independent of electroweak physics. We further predict the presence of new relativistic degrees of freedom in the CFT that should be visible in the next round of CMB experiments. Our mechanism is therefore experimentally falsifiable and predictive.