Contribution ID: **85** Type: **not specified**

Polonyi Inflation

Tuesday, 12 July 2016 15:35 (20 minutes)

In this talk, I will report on my latest work together with Tsutomu Yanagida on an interesting possibility to unify the dynamics of spontaneous supersymmetry breaking and cosmic inflation. Our model is based on strong gauge dynamics, explains the high supersymmetry breaking scale, and also provides an answer to the question "why is there such a thing as cosmic inflation in the first place".

Summary

Spontaneously broken supersymmetry (SUSY) and a vanishingly small cosmological constant imply that R symmetry must be spontaneously broken at low energies. Based on this observation, we suppose that, in the sector responsible for low-energy R symmetry breaking, a discrete R symmetry remains preserved at high energies and only becomes dynamically broken at relatively late times in the cosmological evolution, i.e., after the dynamical breaking of SUSY. Prior to R symmetry breaking, the Universe is then bound to be in a quasi-de Sitter phase—which offers a dynamical explanation for the occurrence of cosmic inflation. This scenario yields a new perspective on the interplay between SUSY breaking and inflation, which neatly fits into the paradigm of high-scale SUSY: inflation is driven by the SUSY-breaking vacuum energy density, while the chiral field responsible for SUSY breaking, the Polonyi field, serves as the inflaton. Because R symmetry is broken only after inflation, slow-roll inflation is not spoiled by otherwise dangerous gravitational corrections in supergravity. We illustrate our idea by means of a concrete example, in which both SUSY and R symmetry are broken by strong gauge dynamics and in which late-time R symmetry breaking is triggered by a small inflaton field value. In this model, the scales of inflation and SUSY breaking are unified; the inflationary predictions are similar to those of F-term hybrid inflation in supergravity; reheating proceeds via gravitino decay at temperatures consistent with thermal leptogenesis; and the sparticle mass spectrum follows from pure gravity mediation. Dark matter consists of thermally produced winos with a mass in the TeV range.

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Session Classification: Parallel V

Track Classification: Inflation and alternatives, Strings, Cosmology