Contribution ID: **165** Type: **not specified**

Random walks in deSitter

Wednesday 9 September 2015 09:40 (20 minutes)

We show how the full quantum description of a scalar field with quartic self-interaction in de Sitter spacetime is equivalent to Brownian motion of a particle in a medium of de Sitter temperature T_DS = H/2π on large wavelengths. We then argue that the system exhibits a fluctuation-dissipation relation and its equilibrium distribution is Maxwell-Boltzmann, implying kinetic and potential energies of comparable magnitudes. The stochastic kinetic energy of the field causes de Sitter spacetime to cool down slowly with a corresponding decrease of the effective vacuum energy. The transition to equilibrium is a semiclassical process beyond the scope of perturbation theory for interacting fields.

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Session Classification: Inflation and phase transitions