Canadian Association of Physicists
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(I) What is the simplicity of the early universe trying to tell us?

Tuesday 20 June 2023 15:15 (30 minutes)

After reviewing some key hints and puzzles from the early universe, I will introduce recent joint work with Neil Turok suggesting a rigid and predictive new approach to addressing them.

Our universe seems to be dominated by radiation at early times, and positive vacuum energy at late times. Taking the symmetry and analyticity properties of such a spacetime seriously leads to a new formula for the gravitational entropy of our universe, and a picture in which the Big Bang may be regarded as a kind of mirror.

I will explain how this line of thought suggests new explanations for a number of observed properties of the universe, including: its homogeneity, isotropy and flatness; the arrow of time (i.e. the fact that entropy increases *away* from the bang); the nature of dark matter (which, in this picture, is a right-handed neutrino, radiated from the early universe like Hawking radiation from a black hole); the origin of the primordial perturbations; and even the existence of three generations of standard model fermions. I will discuss some observational predictions that will be tested in the coming decade, and some key open questions.

Keyword-1

Early-Universe Cosmology

Keyword-2

Dark Matter

Keyword-3

Entropy

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Session Classification: (DTP) T4-4 Hot Topics From Theory Made Accessible | Sujets chauds de la théorie rendus accessibles (DPT)

Track Classification: Symposia Day (Tues. June 20) / Journée de symposiums (mardi, le 20 juin): Symposia Day (DTP - DPT) - Hot Topics From Theory Made Accessible | Les sujets chauds de la théorie rendus accessibles