

SPECIAL PIZZA AMO PHYSICS SEMINAR

“Conformal Cyclic Cosmology”

Sir Roger Penrose

University of Oxford

Abstract

The cosmic microwave background (CMB) provides much of the impressive evidence for an enormously hot and dense early stage of the universe: the *Big Bang*. But was this singular event actually the absolute beginning? Observations of the CMB are now very detailed, but this very detail presents new puzzles, one of the most blatant being an apparent paradox in relation to the Second Law of thermodynamics. The hypothesis of inflationary cosmology has long been argued to explain away some of these puzzles, but it does not resolve some key issues, including that raised by the Second Law. In this talk, I describe a quite different proposal, which posits a succession of universe aeons prior to our own. The expansion of the universe never reverses in this scheme, but the space-time geometry is nevertheless made consistent through a fundamental role for *conformal* (or light-cone) geometry, which is the geometry of physics without mass. Information loss in black-hole evaporation turns out to be central to the Second Law. Some analysis of CMB data, obtained from the WMAP satellite provides a tantalizing input to these issues.

Thursday, March 11, 2010

2:30 p.m., MIST M102

**Texas A&M University
Institute for Quantum Science & Engineering**

(PIZZA, salad, soda to be served at 12:00 noon, MIST Foyer)

Related Talk: TROTTER LECTURE SERIES:* March 11, 2010 • 7:00 PM • Rudder Theater • TAMU

Did the Universe have a Beginning?

Abstract

The current cosmological viewpoint is that the universe started with a big bang, with nothing existing before that, and its present exponential expansion will continue indefinitely. This talk explores some philosophical implications of an alternative scheme: *conformal cyclic cosmology* (CCC), according to which our present cosmological picture represents but one *aeon* in an endless succession of similar aeons, where the infinite future of each becomes the big bang of the next. The universe's material content, at each aeon transition, is taken to be entirely massless particles, insensitive to this infinite change of scale.

There are echoes, in CCC, of the old steady-state model, popular half a century ago, of an eternal universe with no origin, having no need of an external Creator, so one might regard CCC as a scheme of a similar ilk. I take no stand on this, but show that CCC points to a necessary requirement that black-hole evaporation destroys information, leading to a violation of the deterministic evolution of unitary quantum mechanics. Such is a necessary ingredient of my own picture of the existence of consciousness in the universe.

* Sir Roger Penrose is one of the 2010 Trotter Prize recipients! For more information please visit:
<http://ww.science.tamu.edu/trotter>