Contribution ID: **114**   Type: **not specified**

No smooth beginning for spacetime

Thursday 28 September 2017 14:00 (20 minutes)

I will discuss a fundamental obstruction to any theory of the beginning of the universe, formulated as a semiclassical path integral. Hartle and Hawking's no boundary proposal and Vilenkin's tunneling proposal are examples of such theories. Each may be formulated as the quantum amplitude for obtaining a final 3-geometry by integrating over 4-geometries. The result is obtained using a new mathematical tool - Picard-Lefschetz theory - for defining the semiclassical path integral for gravity. The Lorentzian path integral for quantum cosmology with a positive cosmological constant is meaningful in this approach, but the Euclidean version is not. Framed in this way, the resulting framework and predictions are unique. Unfortunately, the outcome is that primordial tensor (gravitational wave) fluctuations are unsuppressed. One can prove a general theorem to this effect, in a wide class of theories.

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Session Classification: Parallel Session: Strings & Mathematical Physics

Track Classification: String & Mathematical Physics