Math & Computer Science Colloquium

Presents:

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Speaking on:

Choosing the right quantum cosmology

In order to model the large-scale evolution of the universe, it is necessary to make simplifying assumptions as to its approximate shape. One typically assumes the universe is highly symmetric, then imposes these symmetries within Einstein's theory of general relativity to solve for a complete history starting with the Big Bang. Such a symmetry-reduced model of the universe is known as a cosmology. However, the Big Bang is also a point of singularity where general relativity breaks down, yielding an infinity when we attempt to compute the curvature of space-time. To obtain a coherent account of the universe's origin, we must construct a quantum version of general relativity able to address the microscopic geometry of space-time and hence to reveal the state of the universe when it was very tiny. Quantizing general relativity is a formidable endeavor which has been underway for the past three-quarters of a century. Quantizing a cosmological model, on the other hand, is relatively straightforward. The difficulty arises when we ask whether this model is accurate to the history of the universe which would be predicted by a full quantization of general relativity. In this talk, I will discuss my ongoing work with collaborators using results from a computer simulation to choose promising quantum cosmologies. We parametrize a family of quantizations and construct a series solution to a differential equation to assess each quantization's prediction about the infancy of our universe.

February 16, 2012
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