JOINT TUFTS/MIT COSMOLOGY SEMINAR

Unitary and non-unitary transitions around a cosmological bounce

Antonin Coutant
MPI Potsdam

In this work, we will discuss the notion of time and unitarity in the vicinity of a bounce in quantum cosmology, that is, a turning point for the scale factor. We start from the Vilenkin interpretation of the solutions of the Wheeler-DeWitt equation. In this approach, unitarity is defined through the conserved current and is by nature an approximate concept. In minisuperspace it amounts to using the scale factor as a time variable. A unitary evolution is recovered when the latter becomes semi-classical enough.

Unfortunately, WKB methods drastically fail near a turning point and the scale factor cannot play the role of time in scenarios with a bounce or a recollapsing phase for the universe. In this work, we extend the results of Vilenkin, Massar and Parentani to momentum representation. For this, we investigate the dynamics of matter transitions when using its conjugate momentum as a time. We describe the precise conditions so as to recover unitarity, and hence, a consistent notion of probability. Then we discuss a concrete example in the vicinity of a bounce.

Tuesday, October 14, 2014, 2:30 pm
Robinson Hall, Room 250
Tufts University

Refreshments at 2:00 in Knipp Library, Room 251