Abstract Submitted
for the APR17 Meeting of
The American Physical Society

Covariance and Quantum Cosmology: A Comparison of Two Matter Clocks[1] THEODORE HALNON, MARTIN BOJOWALD, The Pennsylvania State University — In relativity, time is relative between reference frames. However, quantum mechanics requires a specific time coordinate in order to write an evolution equation for wave functions. This difference between the two theories leads to the problem of time in quantum gravity. One method to study quantum relativity is to interpret the dynamics of a matter field as a clock. In order to test the relationship between different reference frames, an isotropic cosmological model with two matter ingredients is introduced. One is given by a scalar field and one by vacuum energy or a cosmological constant. There are two matter fields, and thus two different Hamiltonians are derived from the respective clock rates. Semi-classical solutions are found for these equations and a comparison is made of the physical predictions that they imply.

[1]Partial funding from the Ronald E. McNair Postbaccalaureate Achievement Program

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Date submitted: 26 Sep 2016 Electronic form version 1.4