Abstract Submitted
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Measure and Probability in Cosmology JOSHUA SCHIFFRIN, ROBERT WALD, The University of Chicago — General relativity has a Hamiltonian formulation, which formally provides a canonical (Liouville) measure on the space of solutions. A number of authors have used the restriction of this measure to the space of homogeneous and isotropic universes with scalar field matter (minisuperspace)—namely, the Gibbons-Hawking-Stewart measure—to make arguments about the likelihood of inflation. We argue here that there are at least four major difficulties with using the measure of general relativity to make probability arguments in cosmology: (1) Equilibration does not occur on cosmological length scales. (2) Even in the minisuperspace case, the measure of phase space is infinite and the computation of probabilities depends very strongly on how the infinity is regulated. (3) The inhomogeneous degrees of freedom must be taken into account even if one is interested only in universes that are very nearly homogeneous. The measure depends upon how the infinite number of degrees of freedom are truncated, and how one defines "nearly homogeneous". (4) In a universe where the second law of thermodynamics holds, one cannot make use of our knowledge of the present state of the universe to "retrodict" the likelihood of past conditions.

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