Abstract Submitted
for the APR14 Meeting of
The American Physical Society

The Instability of Global de Sitter Space to Particle Creation EMIL MOTTOLA, Los Alamos National Laboratory, PAUL ANDERSON, Wake Forest Univ. — Global de Sitter space is unstable to particle creation, even for a massive free field theory with no self-interactions. The O(4,1) de Sitter invariant state is a definite phase coherent superposition of particle and anti-particle solutions in both the asymptotic past and future, and therefore is not a true vacuum state. In the closely analogous case of particle creation by a constant, uniform electric field, a time symmetric state analogous to de Sitter invariant one also exists, which is also not a particle vacuum state. The particle creation process, the mean particle number, and quantities such as energy-momentum tensor of the created particles can all be studied in real time. The energy-momentum tensor in the initial adiabatic vacuum state in de Sitter space in global S^3 sections is computed and shows that particle creation in the contracting phase results in an exponentially large energy density at later times, necessitating an inclusion of their backreaction effects, and leading to large deviation of the spacetime from global de Sitter space before the expanding phase can begin. The instability has consequences for cosmology and the problem of quantum vacuum energy in gravity.

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Date submitted: 09 Jan 2014 Electronic form version 1.4