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Quantum Vacuum Instability of "Eternal" de Sitter Space EMIL MOTTOLA, Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM 87545 USA — The Euclidean or Bunch-Davies state of quantum fields in global de Sitter space is shown to be unstable to small perturbations, even for a massive free field with no self-interactions. There are perturbations of this state with arbitrarily small energy density at early times that is exponentially blueshifted in the contracting phase of "eternal" de Sitter space, and becomes large enough to disturb the classical geometry through the semiclassical Einstein eqs. at later times. In the closely analogous case of a constant, uniform electric field, a time symmetric state equivalent to the de Sitter invariant one is constructed, which is also not a stable vacuum state under perturbations. The role of a quantum anomaly in the growth of perturbations and symmetry breaking is emphasized in both cases. The anomaly stress tensor shows that states invariant under the $O(4)$ subgroup of the de Sitter group are also unstable to perturbations of lower spatial symmetry, implying that both the $O(4)$ subgroup are broken by quantum fluctuations. Consequences of this result for cosmology and the problem of vacuum energy will be discussed.

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