Abstract Submitted
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The Basis of the Second Law of Thermodynamics in Quantum Field Thoery[1] DAVID SNOKE, GANGQIANG LIU, Department of Physics and Astronomy, University of Pittsburgh, STEVEN GIRVIN, Department of Physics, Yale University — We derive the quantum Boltzmann equation for a closed system with a two-particle collision process on the basis of quantum field theory. In the thermodynamic limit, the system evolves deterministically and irreversibly towards equilibrium, on the time scale of the scattering time of the particles. This irreversibility is related to the loss of information which comes from the vanishing off-diagonal phase coherence in the system. By calculating the time evolution of the off-diagonal elements of the generalized density matrix, we show that these terms decay rapidly due to the interaction. In the case of Bose-Einstein condensates, all phase coherence is not lost. We deduce the onset of phase coherence in a Bose-Einstein condensate, which gives rise to macroscopic wavelike behaviors of Bose systems. We also derive the H-theorem by combining our results with standard definitions of entropy.

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