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Thermalization and Entropy in Nuclear Pairing Phase Transition[1]

TONY SUMARYADA, ALEXANDER VOLYA, Department of Physics Florida State University, Tallahassee FL 32306 — We present a study of pairing phase transitions in the mesoscopic nuclear systems. Our investigation includes analysis of different thermodynamic ensembles, study of discontinuities in associated thermodynamic variables, and examination of zeros of the partition functions in the complex plane. Apart from the traditional methods of thermodynamics we use an Invariant Correlational Entropy (ICE) as a new powerful tool to address the onset of nuclear superconductivity in individual quantum states. The ICE in an invariant and basis independent way characterizes the system in a given noise where pairing strength, a parameter of the Hamiltonian, is treated as a part of the statistical ensemble. Although, ICE is fundamentally different from the thermodynamic entropy we find the manifestations of the parameter driven noise to be very similar to that of the thermal ensemble. Thermalization of mesoscopic paired systems and related questions are also to be discussed.

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