[Talk 27] Scaling law for irreducible entropy production in critical systems

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Jarzynski derived a celebrated equality formulation for non-equilibrium processes. The Jarzynski equality, however, is deviated in absolute irreversible processes, and it is practically difficult to verify with finite sampling. We noticed that these two issues are naturally embedded in a quenching process across the critical point of second-order phase transitions. We considered the Ising model as a prototypical example for spontaneous symmetry breaking, and examined a quenching process from ordered to disordered spin states by controlling the ferromagnetic coupling constant. We then found that the entropy production during the quenching process followed a scaling law inherited from the critical scaling laws of second-order phase transitions. Our findings may provide an application of the Jarzynski equality to study the dynamical properties of phase transitions.