[P5] Time Irreversibility at Nonequilibrium Phase Transition

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We investigate the emergence of macroscopic time irreversibility out of microscopic dynamics with broken detailed balance. We focus on a nonequilibrium system consisting of interacting Brownian particles in two dimensions. Particles in a thermal bath are acted on by a nonequilibrium velocity-aligning force that favors a collective motion. We find that the total entropy production is subextensive in the disordered phase without the collective motion. The entropy production becomes extensive in the ordered phase as the collective motion emerges. The scaling relations are derived between the critical exponents describing the entropy production rate density and those describing the order parameter.