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Decondensation and slow equilibration of photonic condensates

Photonic condensates are complex systems exhibiting phase transitions due to the interaction with their molecular environment. By varying pump and thermalization the system can be tuned between Bose-Einstein condensation, multimode condensation, and lasing. We present a rich non-equilibrium phase diagram which exhibits transitions between these phases, including decondensation of individual modes under conditions that would typically favor condensation. In simulations of system dynamics, we investigate the response of the photonic gas to quenches in the pump power. In addition to the expected

dramatic critical slowing down of the equilibration time around phase transitions we find extremely slow equilibration even far away from phase transitions, and we provide a quantitative explanation for this non-critical slowing down.