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Thermalization and temperature distribution in a driven ion chain GUIN-DAR LIN, LUMING DUAN, University of Michigan — We study thermalization and non-equilibrium dynamics in a dissipative quantum many-body system — a chain of ions with two points of the chain driven by thermal bath under different temperature. Instead of a simple linear temperature gradient as one expects from the classical heat diffusion process, the temperature distribution in the ion chain shows surprisingly rich patterns, which depend on the ion coupling rate to the bath, the location of the driven ions, and the dissipation rates of the other ions in the chain. We discuss implementation issues and show these unusual temperature distribution patterns in the ion chain can be quantitatively tested through experimental observation. A direct application is continuous sympathetic cooling in a scalable trapped ion quantum computer. We demonstrate the architecture how the ion chain can be maintained cooled efficiently to guarantee high-fidelity computation.

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