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Nonequilibrium quantum dynamics of partial symmetry breaking for a vortex state of ultracold bosons in a ring trap[1] XINXIN ZHAO, Peking University, and Colorado School of Mines, MARIE A. MCLAIN, Colorado School of Mines, JAVIER VIJANDE, Universidad de Valencia (UV) and IFIC (UV-CSIC), ALBERT FERRANDO, Universitat de Valéncia, LINCOLN D. CARR, Colorado School of Mines, and Universität Heidelberg, MIGUEL A. GARCIA, Colorado School of Mines, and Universitat de Barcelona — One common subject for an isolated system is the memory of the system's initial conditions after a parameter change, such as a quantum quench. We investigate a vortex in a Bose-Einstein condensate on an optical ring lattice in response to partial symmetry breaking. Bosons are originally trapped in a discrete ring trap with six sites and periodic boundary conditions, whose six-fold rotational symmetry is suddenly broken but retains a three-fold rotational symmetry. During real time evolution, no critical behavior is manifested in the system's microscopic and macroscopic features, fidelity and total current. Instead, a critical point at which the system forgets its initial symmetry state is well characterized by a new measurement, symmetry memory. Similar critical phenomena are equally discovered in larger systems, which makes it pervasive in this type of partial symmetry breaking. Further studies uncover a physical understanding of the two typical trends of critical symmetry breaking strength with the help of a newly identified energy gap in the low-lying excited states identified by its discrete rotational symmetry properties.

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