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Finite–temperature effects in stirred ring Bose–Einstein condensates[1] N. MURRAY, C. LANIER, M. EDWARDS, Georgia Southern University, Y.-H. WANG, C.W. CLARK, Joint Quantum Institute — A ring Bose–Einstein condensate (BEC) with zero circulation ($m = 0$) stirred by a barrier will eventually jump to an $m = 1$ state when stirred faster than a certain critical speed, Ω_c^+. A ring BEC with $m = 1$ will drop to $m = 0$ when stirred at a critical speed, Ω_c^-, which is lower than Ω_c^+. The loop areas, $\Omega_c^+ - \Omega_c^-$, of this hysteretic response of the BEC to stirring predicted by zero–temperature Gross–Pitaevskii equation (GPE) disagreed significantly with the results of a recent experiment. In the work reported here, we simulated this experiment with the phenomenologically damped GPE, [S. Choi, S. A. Morgan, and K. Burnett, Phys. Rev. A **57**, 4057 (1999)], and with the Zaremba–Nikuni–Griffin (ZNG) theory. The ZNG theory can account for finite–T, non–equilibrium dynamics. We compare the results of these simulations with the experimental data. The simulations show that a vortex/antivortex pair forms in the barrier region during the stirring and that this drives the hysteresis. We also show how the presence of an interacting, thermal cloud affects the dynamics of these pairs. We also simulate a ring condensate stirred by two barriers and find that the GPE matches the data much more closely.

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