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Thermal and quantum fluctuation effects in rotational hysteresis of ring Bose–Einstein condensates[1] M. EDWARDS, C. HELLER, Georgia Southern Univ, Y.-H. WANG, C.W. CLARK, Joint Quantum Institute — In a recent experiment [2] a ring Bose–Einstein condensate (BEC) with zero circulation (with winding number $m = 0$) and stirred by a barrier jumped to an $m = 1$ state when stirred faster than a certain critical speed, Ω_{+c}. Conversely an $m = 1$ condensate dropped to $m = 0$ when stirred below a critical speed, $\Omega_{?c}$, which was lower than Ω_{+c}. The hysteresis loop areas, $\Omega_{+c} - \Omega_{-c}$, disagreed significantly with the predictions of the zero–temperature Gross–Pitaevskii equation. We report the results of simulating this experiment with both the Zaremba–Nikuni–Griffin (ZNG) theory and the Truncated Wigner Approximation (TWA). The ZNG theory can account for thermal fluctuations while the TWA can also account for quantum fluctations of the gas. We compare the results of these simulations with the experimental data and describe how the dynamics of vortex/antivortex pairs formed in the barrier region during the stirring is modified by the presence of a thermal cloud and by quantum fluctuations beyond the mean field.

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[2]S. Eckel, et al., *Nature* **506**, 200 (2014)

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