Size and Dynamics of Vortex Dipoles in Dilute Bose–Einstein Condensates

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Being the hallmark of superfluidity, quantized vortices have been under intense research in dilute Bose–Einstein condensates (BECs) of alkali-metal atoms. Lately, there has been great experimental and theoretical interest in so-called vortex dipoles, pairs of quantized vortices of opposite circulation. In particular, Freilich *et al.*[1] recently observed stationary vortex dipoles for the first time in a BEC experiment. To explain their observations, we perform simulations based on the Gross–Pitaevskii equation and obtain excellent quantitative agreement on the size of the stationary dipole.[2] We also investigate how their multishot imaging method, in which atoms are repeatedly extracted from a single condensate, affects the vortex dynamics. We find that it mainly induces isotropic size oscillations of the BEC without otherwise disturbing the vortex trajectories. Thus, the imaging technique appears to be a promising tool for studying vortex dynamics in real time.

[1]D. V. Freilich, D. M. Bianchi, A. M. Kaufman, T. K. Langin, and D. S. Hall, Science **329**, 1182 (2010).
[2]P. Kuopanportti, J. A. M. Huhtamäki, and M. Möttönen, Phys. Rev. A **83**, 011603(R) (2011).