SUPPLEMENTAL MATERIAL

In this supplement we provide detailed information about the simulations, list of attached movies as well as comparison of the SLDA simulations with the corresponding ETF simulation.

A. Simulation parameters

Simulations are done in a box of size $n_x \times n_y \times n_z$, where $n_x = n_y = 32$ and $n_z = 128$. The simulations contain $N \approx 560$ particles in the following trapping potential:

$$V(x, y, z) = \frac{m}{2}\omega_x^2 x^2 + \frac{m}{2}\omega_y^2 y^2 + \frac{m}{2}\omega_z^2 z^2 + Cy^3,$$

where aspect ratio of the trap $\omega_\perp/\omega_z = 4$ ($\omega_\perp = \sqrt{\omega_x \omega_y}$) is fixed. The remaining trap parameters are characterized by an anisotropy: $\delta = 1 - \omega_y/\omega_x$, and an anharmonicity: C/C_0, where $C_0 = m\omega_y^2/2R$ and R is Thomas-Fermi radius. The simulation requires to evolve $57,849$ two component wave-functions in real time. In order to integrate equations of motion we use a symplectic split-operator method that respects time-reversal symmetry launched on hundreds of GPUs on the Titan supercomputer.

B. Movies – Fermionic Simulations

Movies show paring field profiles (blue surfaces) and location of a vortex (red line) identified as points around which phase of the paring field rotates by 2π.

`A.mp4`: [`http://youtu.be/VxvOPsOs-6s`]
Parameters: $\delta = 9\%$, $C/C_0 = 0\%$.

`B.mp4`: [`http://youtu.be/gIfhB7QrGxU`]
Parameters: $\delta = 0.5\%$, $C/C_0 = 0\%$.

`C.mp4`: [`http://youtu.be/7qGO3kmN-fs`]
Parameters: $\delta = 9\%$, $C/C_0 = 3\%$.

`D.mp4`: [`http://youtu.be/K74GUp1cDnM`]
Parameters: $\delta = 0.5\%$, $C/C_0 = 0.15\%$.

`E.mp4`: [`http://youtu.be/0pg8N91-gZ0`]
Parameters: $\delta = -10\%$, $C/C_0 = 3\%$.

`F.mp4`: [`http://youtu.be/_aWO0tIOOdw`]
Parameters: $\delta = 0\%$, $C/C_0 = 0\%$.
Comment: The edge knife is tilted by angle $\pi/20$ rad.

`G.mp4`: [`http://youtu.be/utpkynd1Qkc`]
Parameters: $\delta = 0\%$, $C/C_0 = 0\%$.
Comment: Simulation with two edge knifes tilted by angle $\pi/20$ rad with different orientation.

`H.mp4`: [`http://youtu.be/7xlG15TUNQs`]
Parameters: $\delta = 9\%$, $C/C_0 = 3\%$.
Comment: The edge knife is tilted by angle $\pi/20$ rad and rotated in a such way to generate oblique vortex line.

C. Movies – Bosonic Simulations (extended Thomas-Fermi model)

Movies show order parameter $2|\Psi|$ profiles (blue surfaces) and location of a vortex (red line) identified as points around which phase of the order parameter rotates by 2π. Results are obtained using the same lattice parameters as in case of fermionic simulations.

`A.ETF.mp4`: [`http://youtu.be/uDuOOVOO5D4`]
Parameters: $\delta = 9\%$, $C/C_0 = 0\%$.

`B.ETF.mp4`: [`http://youtu.be/VUrlvJglqkI`]
Parameters: $\delta = 0.5\%$, $C/C_0 = 0\%$.

`C.ETF.mp4`: [`http://youtu.be/L5ONtMQDfgE`]
Parameters: $\delta = 9\%$, $C/C_0 = 3\%$.

`D.ETF.mp4`: [`http://youtu.be/HOIB-R1TwJU`]
Parameters: $\delta = 0.5\%$, $C/C_0 = 0.15\%$.

`E.ETF.mp4`: [`http://youtu.be/EXLOlBbsKS8`]
Parameters: $\delta = -10\%$, $C/C_0 = 3\%$.

D. Simulation of Quantum Turbulence

The simulation of quantum turbulence was done with lattice $48 \times 48 \times 128$, and particle number $N = 1410$. The confining potential is axially symmetric ($\delta = 0\%$) with aspect ratio $\omega_\perp/\omega_z = 2.67$. There is no anharmonicity term ($C/C_0 = 0\%$). Number of two component wave-functions to be evolved in real time is $131,629$ and to integrate equations of motion we used 2048 Titan's GPUs. As the stirrers we used repulsive Gaussian potentials of width 1.25 of lattice spacing and amplitude $0.75\varepsilon_F$. We provide two movies:

`QT.mp4`: [`http://youtu.be/nCGtq8k6SAQ`]
Dynamics of the cloud showing paring field profiles (blue surfaces).

E. Comparison of Fermionic and Bosonic Simulations

On the next page we compare the SLDA simulations presented in the main body of the paper (top of each figure) with the corresponding ETF simulation with the same initial conditions and preparation.

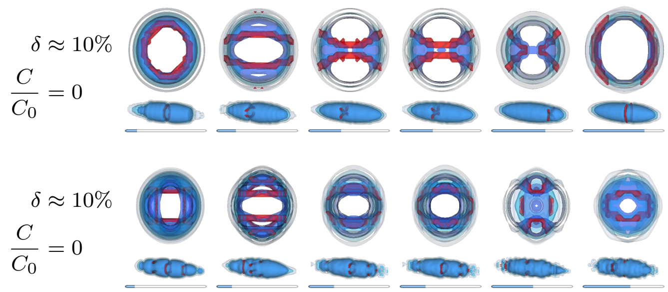

FIG. 6. (Color online, click on frames to view movie online.) ETF analogue of the SLDA simulation in the top of Fig. 2

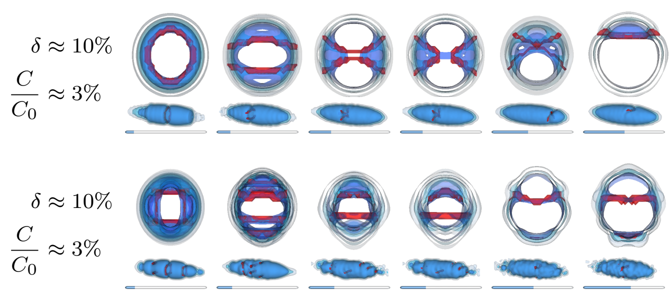

FIG. 7. (Color online, click on frames to view movie online.) ETF analogue of the SLDA simulation in the bottom of Fig. 2

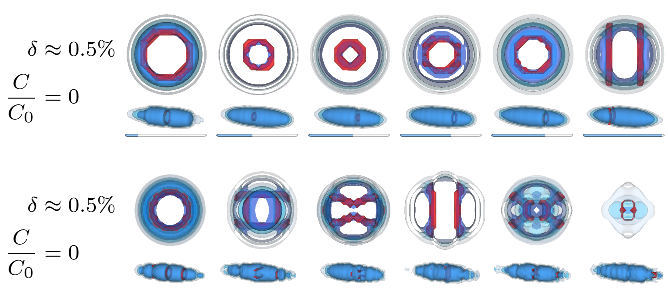

FIG. 8. (Color online, click on frames to view movie online.) ETF analogue of the SLDA simulation in the top of Fig. 3

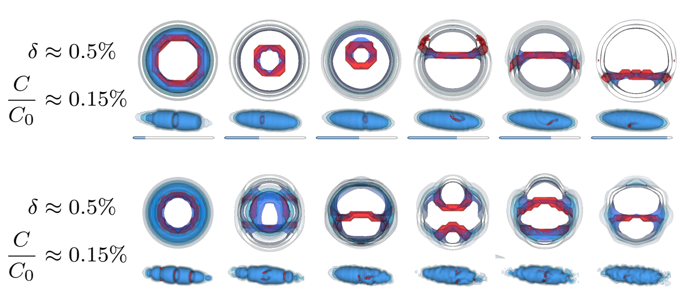

FIG. 9. (Color online, click on frames to view movie online.) ETF analogue of the SLDA simulation in the bottom of Fig. 3

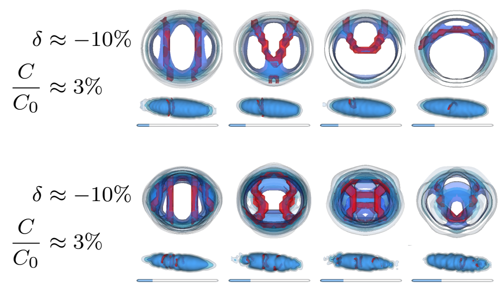

FIG. 10. (Color online, click on frames to view movie online.) ETF analogue of the SLDA simulation in the top of Fig. 4