

# Cold atoms 2: Quantum Hydrodynamics

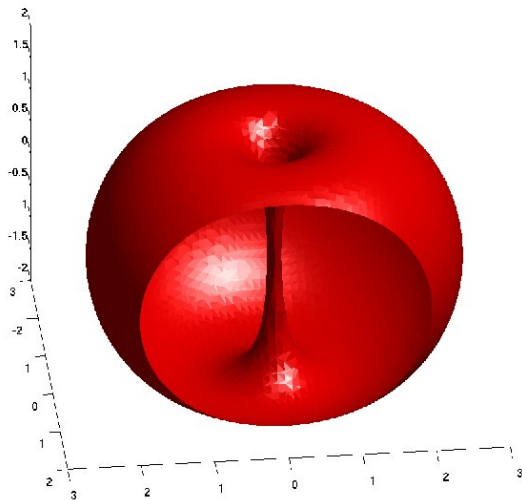
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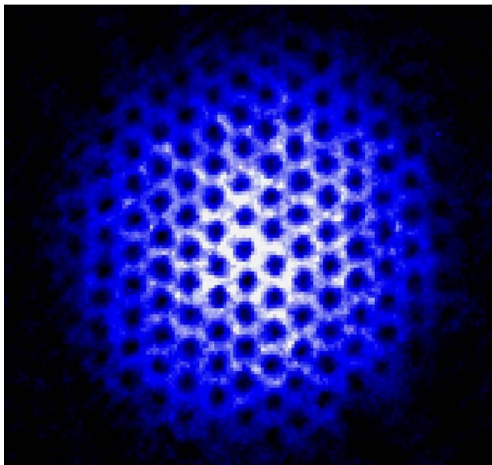
April 14, 2011

# Vortex line



Numerical solution

# Vortex lattice



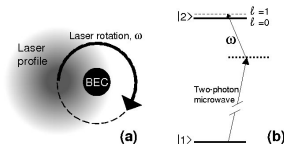
Ketterle experiment, 2000: Abrikosov lattice in a trapped BEC

# Making vortices

Stir the fluid with a laser beam

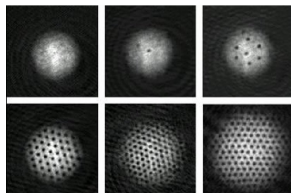


or use ingenious phase imprinting techniques



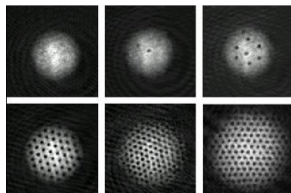
# Detection of vortices

Direct imaging impossible: Core too small!  
But let cloud expand freely; then observe

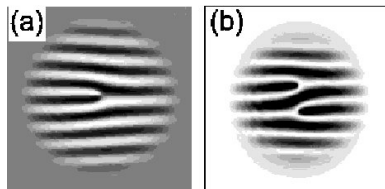


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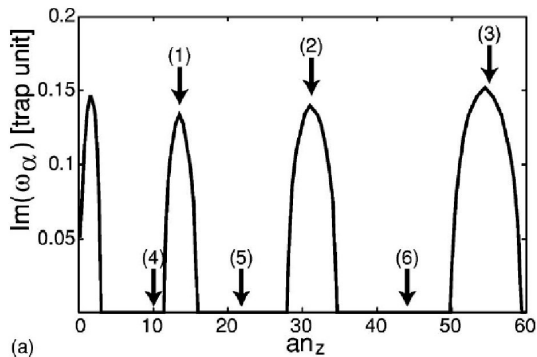
Interference fringes between two condensates reveal phase patterns



# Stability analysis

(blackboard lecture)

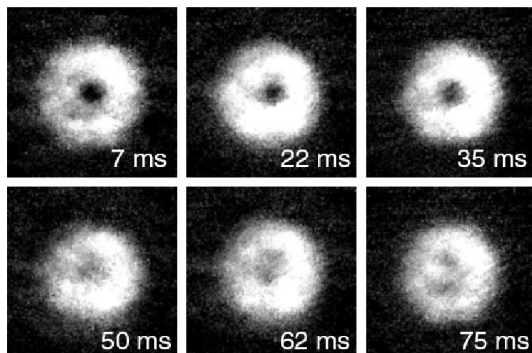
# Vortex instabilities in 2D



Möttönen *et al.* 2004

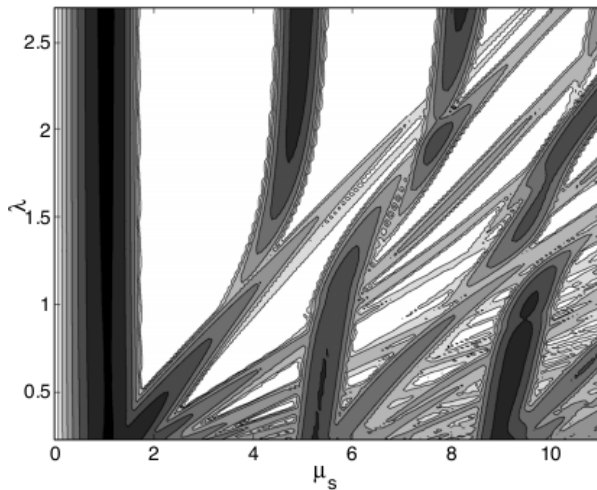


# Splitting of a doubly quantized vortex



Experiment by Ketterle *et al.* 2004

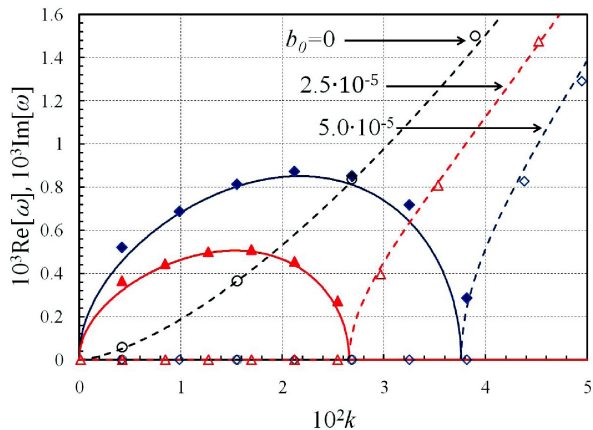
# Vortex instabilities in 3D



Lundh, Nilsen 2007

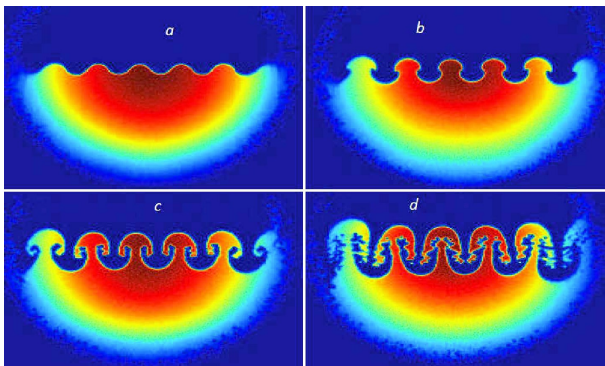
(blackboard lecture)

# Rayleigh-Taylor instability



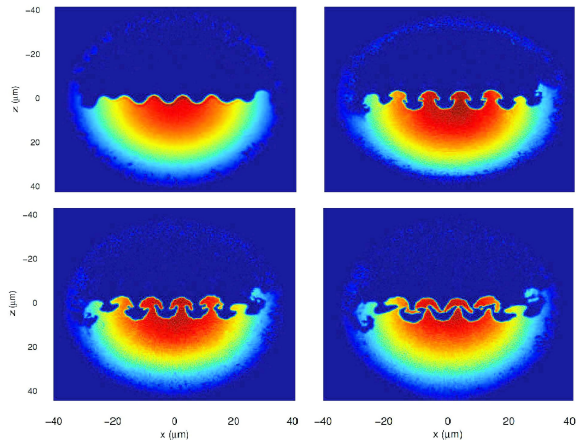
Kobyakov *et al.*, to be published

# Rayleigh-Taylor instability



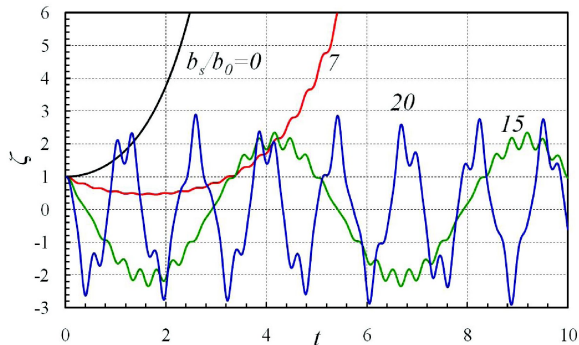
Bezett *et al.*, to be published

# Richtmyer-Meshkov instability



Bezett *et al.*, 2010

# Stabilization of R-T instability



Kobyakov *et al.*, to be published

Thank you for your attention