Dynamics in Spatially Confined Hamiltonian Systems

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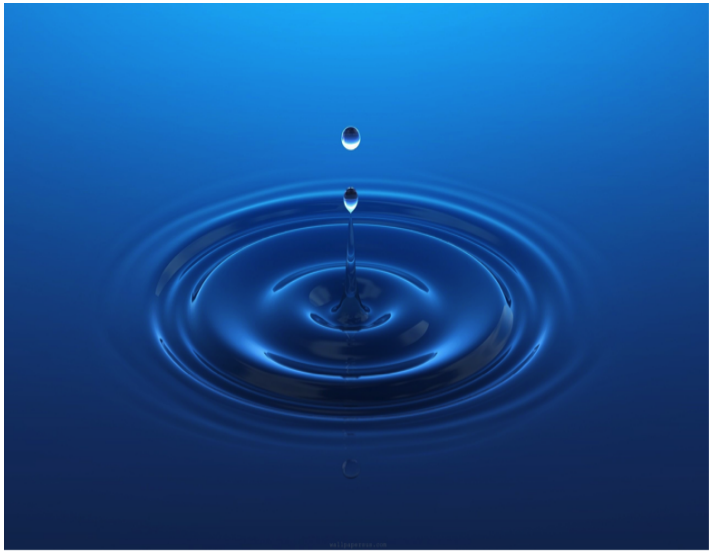
Propagation of nonlinear waves

Unbounded domain



Bounded domain

System settles down to equilibrium
via dissipation of energy by dispersion

Waves keep interacting for all times,
generating out-of-equilibrium dynamics

- Understanding of long-time behavior of nonlinear waves in spatially confined systems is a very challenging problem
- Our goal is to advance this understanding

Nonlinear waves in spatially confined systems

- There are different mechanisms of confinement: compact domain, trapping potential, or a timelike boundary
- Key questions:
  - How the energy injected into the system gets distributed over the degrees of freedom during the evolution?
  - Can the energy flow to arbitrarily small wavelengths (*weak turbulence*)?
- The proposal lies at the interface between the theory of nonlinear dispersive equations and various areas of nonlinear physics:
  - wave and quantum turbulence
  - general relativity
  - gauge/gravity duality
- Possible applications:
  - motion of vortices in Bose-Einstein condensates
  - modeling of surface water waves
  - engineering efficient fiber optics cables

Why now?

- Hot emerging area of research, both in mathematics and physics
- Despite recent progress, this area remains largely unexplored

Why us?

- Experience in studies of nonlinear systems
- Unique style of research and extensive toolbox
- Promising preliminary results
- Great team of collaborators and students