Solitons, vortices, and related nonlinear textures in quantum gases

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Nonlinear structures in quantum gases can be long-lived due to either topological properties, in the case of vortices, or the abundance of (nearly preserved) conservation laws. In the presence of confining geometries, interesting bifurcation and cross-over scenarios blur the notions of what solitons or vortices behave like. I will discuss these scenarios in the context of solitonic vortices and Josephson vortices. Finally, I will discuss the interesting properties of Majorana solitons, which are dark solitons in a topological superfluid that carry Majorana quasiparticle excitations.

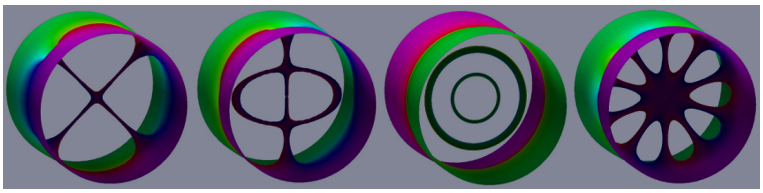

Figure 1: Chladni solitons form a family of nonlinear waves in confined superfluids with solitary wave character that posses internal structure in the form of vortex lines. Reminiscent of Chladni figures that visualise the nodal structure of plate vibrations, Chladni solitons trace the nodal lines of unstable modes of planar dark solitons.