

Holographic Superfluid Solitons with Backreaction

Yiqiang Du[#]

(Affiliation: Hanyang University)

Soliton configurations exist in BEC superfluids as well as BCS superconductors, allowing to probe the BEC-BCS crossover. In holographic superfluids, the BEC-BCS crossover can be achieved by changing the boundary conditions for the charged scalar field dual to the order parameter condensate. This mechanism has been previously in the probe limit, neglecting the backreaction of the order parameter condensate on the dual geometry. In this work, we investigate the BEC and BCS limits including backreaction by constructing the corresponding dark soliton configurations in holography. We then study in detail the dependence of several observables such as the charge depletion and energy density in the core of the soliton on the strength of backreaction strength as parametrized by the Newton constant in the holographic bulk geometry. We in particular find that the charge depletion at the core of the soliton decreases with increasing backreaction strength, which we interpret qualitatively in terms of charge conservation in the boundary theory. Finally, the inclusion of back reaction enables us to obtain the effective energy density of the soliton configurations, which together with a calculation of the surface tension leads to a physical explanation of the snake instability of dark solitons.