Bubbles and Rings of Cold Quantum Gas: Dressed-Atom Approach

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Ultra-cold atoms have been controlled with magnetic fields for several decades now. Part of the cooling process has often been the use of radio-frequency fields to out-couple energetic atoms. However, the same rf fields can be used to create adiabatic traps for atoms, which can also be at the point of resonance [1,2]. In turn this has allowed the creation of atom traps with new topologies. For example, in free-fall, space, or in a drop tower, we can make a bubble of matter-waves, or BEC.

In particular, NASA's BEC experiment in orbit (the Cold Atom laboratory, or CAL [3,4] has stimulated wide interest in the creation and physics of bubbles of quantum gas [5]. This includes the collapse and expansion of bubbles, vortices on closed surfaces, and vibration of bubbles. In this talk we will recap on how the NASA experiment can be enhanced for bubble physics experiments and how diagnostic information is analysed with a simple model of the free-expansion of shells. We also discuss applications to ring structures and the effects of noise in microgravity.

References

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