

Ultra-cold Quantum Fluids

Saeed H. Abedinpour

Department of Physics, Institute for Advanced Studies in Basic Sciences
(IASBS), Zanjan 45137-66731, Iran

School of Physics, Institute for Research in Fundamental Sciences (IPM), Tehran
19395-5531, Iran

The hyper-controllability of ultra-cold atomic gases have made them an ideal tool for testing different theoretical models. In particular, simulating different model Hamiltonians of interest for theoretical condensed matter physicists have become a routine in several labs around the world.

In these lectures, I will begin with a motivational review of ultra-cold atomic systems. I will do my best to show why the physics of atoms and molecules have become of interest in different branches of physics, and in particular in condensed matter physics. Then, I will move to discuss different many-body methods for studying the ground-state (GS) and dynamical properties of interacting quantum fluids of ultra-cold gases. Finally, I will apply these many-body techniques to dipolar quantum fluids and discuss their different GS and dynamical properties.