Ultracold atomic physics in microgravity: Survey and rf-dressing techniques

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Moving ultracold atomic physics investigation into microgravity affords a variety of experimental opportunities, including the potential for increased free interaction time, reduced temperature via freefall-enabled cooling schemes, and the elimination of gravitational tilt mgz on atomic ensembles. Here I review physics that has been and is being explored in microgravity, including with the NASA Cold Atom Laboratory (CAL) aboard the International Space Station. I also will lay out basic theoretical framework and modeling approaches for radiofrequency dressing techniques, which are key to using microgravity cold-atom machines to generate novel structures in microgravity that are otherwise inaccessible in the presence of gravity.

Ultracold atomic physics in microgravity: Bubble dynamics and outlook

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Ultracold atomic physics experiments historically have been driven by the exploration of the parameter space of geometry, topology, interactions, and temperature. Here I survey the motivation and recent data regarding a particular new window of geometry and topology: ultracold bubble dynamics; that is, exploration of the physics of Bose-Einstein condensates (or nearly condensed samples) confined to the surface of an ellipsoid. will review general theoretical understanding (much of which has been achieved in the last few years), review bubble imaging/data from microgravity apparatus, delineate current limitations and challenges, and discuss open questions and next-generation experimental plans.