

DAMOP11-2011-020008

Abstract for an Invited Paper
for the DAMOP11 Meeting of
the American Physical Society

I.I. Rabi Prize in Atomic, Molecular and Optical Physics Talk: Novel Quantum Physics in Few- and Many-body Atomic Systems

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Recent cold atom researches are reaching out far beyond the realm that was conventionally viewed as atomic physics. Many long standing issues in other physics disciplines or in Gedanken-experiments are nowadays common targets of cold atom physicists. Two prominent examples will be discussed in this talk: BEC-BCS crossover and Efimov physics. Here, cold atoms are employed to emulate electrons in superconductors, and nucleons in nuclear reactions, respectively. The ability to emulate exotic or thought systems using cold atoms stems from the precisely determined, simple, and tunable interaction properties of cold atoms. New experimental tools have also been devised toward an ultimate goal: a complete control and a complete characterization of a few- or many-body quantum system. We are tantalizingly close to this major milestone, and will soon open new venues to explore new quantum phenomena that may (or may not!) exist in scientists' dreams.