SPECTROSCOPY ON EXTREMELY WEAKLY-BOUND MOLECULES: COOPER PAIRS AND EFIMOV TRIMERS

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Recent research on ultracold atoms and molecules entered an exciting era in which atomic and molecular interactions can be fully controlled and engineered to simulate a broad range of few- and many-body phenomena in condensed matter, molecular physics and even nuclear physics. In this talk I will present two examples.

The first example is degenerate Fermi gas with resonant interactions. Our studies of Fermion pairs from precision radio-frequency spectroscopy provide new views on many-body pairing and phase transitions in strongly interacting Fermi systems[a]. This work was ranked one of the top 10 science breakthroughs in year 2004 by Science magazine.

The second one is the observation of a three-body Efimov state, which was conjectured in 1970 by a Russian physicist V. Efimov in the context of nuclear physics. Efimov trimers exist in general Bose systems when the binary interaction is resonantly enhanced. The observation of an Efimov state[b] opens up new horizon to explore few-body physics in the quantum degeneracy regime[c].

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[a] C. Chin, M. Bartenstein, A. Altmeyer, S. Riedl, S. Jochim, J. Hecker Denschlag, and R. Grimm, *Science* **305**, 1128 (2004)

[b] T. Kraemer, M. Mark, P. Waldburger, J. G. Danzl, C. Chin, B. Engeser, A. D. Lange, K. Pilch, A. Jaakkola, H.-C. Nägerl and R. Grimm, *Nature* **440**, 315 (2006)

[c] C. Chin, T. Kraemer, M. Mark, J. Herbig, P. Waldburger, H.-C. Nägerl, and R. Grimm, *Phys. Rev. Lett.* **94**, 123201 (2005).