

Joint CQSE & NCTS Seminar

2023
May. 05, Friday

TIME May. 05, 2023, 14:30~15:30pm
TITLE Quantum Simulators with Two Species of Atoms: Progress,
Challenges, and Future Applications
SPEAKER Prof. Shih-Kuang Tung
(Department of Physics, National Tsing Hua University)
PLACE NCTS Physics Lecture Hall, 4F, Chee-Chun Leung
Cosmology Hall, NTU
ONLINE <https://nationaltaiwanuniversity-zbn.my.webex.com/>



Abstract:

Atoms are ideal quantum objects; abundant in nature and each atom of the same kind is perfectly identical. Due to their universal properties, atoms have been used for quantum simulations for decades. With atomic quantum simulators, numerous important many-body models have been observed and studied, including the Superfluid-Mott insulator transition, Tonks-Girardeau gas, BEC-BCS crossover, and BKT transition in 2D atomic systems. As our ability to control these simulators advances, we also seek to add new complexity to them, for example, the integration of a second species. In this talk, I will report on our progress in creating a quantum simulator with two species of atoms and discuss our plans for future applications.

Biography Brief:

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Ph.D. in Physics, JILA (University of Colorado at Boulder and NIST) 2010

Thesis: Probing an Interacting Bose Gas in a Quasi-Two-Dimensional Trap

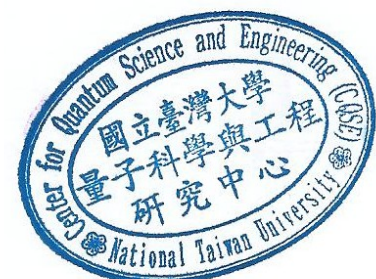
Advisor: Prof. Eric Cornell

Appointments

- Assistant professor, National Tsing Hua University (Taiwan), 2016/8 – present

Publications

1. W.-X. L, Y.-D. Chen, Y. -T. Sun, S. Tung, and Paul S. Julienne, Feshbach resonances in an ultracold $7\text{Li}133\text{Cs}$ Bose-Bose mixture, *Phys. Rev. A*, 106, 023317 (2022).
2. Y.-D. Chen, W.-X. Li, M.-E. Chou, C.-S. Kuo, C.-S. Li, and Tung, S., Lithium-cesium slow beam from a two-dimensional magneto-optical trap, *Phys. Rev. A* 103, 023102 (2021).
3. S. Tung, K. Jim'enez-Garc'ia, J. Johansen, C. Parker, and C. Chin, Geometric Scaling of Efimov States in a $6\text{Li}133\text{Cs}$ Mixture, *Phys. Rev. Lett.*, 113, 240402 (2014).
4. L.-C. Ha, C.-L. Hung, X. Zhang, U. Eismann, S. Tung, and C. Chin, Strongly Interacting TwoDimensional Bose Gases, *Phys. Rev. Lett.*, 110, 145302 (2013).
5. S. Tung, C. Parker, J. Johansen, C. Chin, Y. Wang, and P. Julienne, Ultracold Mixture of 6Li and 133Cs Atoms with Tunable Interactions, *Phys. Rev. A.*, 87, 010702(R) (2013).
6. X. Zhang, C.-L. Hung, S. Tung, and C. Chin, Observation of Quantum Criticality with Ultracold Atoms in Optical Lattices, *Science* 335, 1070 (2012).
7. C.-L. Hung, X. Zhang, L.-C. Ha, S. Tung, N. Gemelke, and C. Chin, Extracting Density-Density Correlations from In-Situ Images of Atomic Quantum Gases, *New. J. Phys.* 13, 075019 (2011).
8. X. Zhang, C.-L. Hung, S. Tung, N. Gemelke, and C. Chin, Exploring Quantum Criticality Based on Ultracold Atoms in Optical Lattices, *New. J. Phys.* 13, 045011 (2011).
9. S. Tung, G. Lamporesi, D. Lobser, L. Xia, E. A. Cornell, Observation of Presuperfluid Regime in a Two-Dimensional Bose Gas, *Phys. Rev. Lett.* 105, 230408 (2010).
10. V. Schweikhard, S. Tung, S, and E. A. Cornell, Vortex Proliferation in the Berezinskii-KosterlitzThouless Regime on a Two-Dimensional Lattice of Bose-Einstein Condensates, *Phys. Rev. Lett.* 99, 030401 (2007).
11. S. Tung, V. Schweikhard, and E. A. Cornell, Observation of Vortex Pinning in Bose-Einstein Condensates, *Phys. Rev. Lett.* 97, 240402 (2006).
12. I. Coddington, P. C. Haljan, P. Engels, V. Schweikhard, S. Tung, and E. A. Cornell, Experimental Studies of Equilibrium Vortex Properties in a Bose-Condensed Gas, *Phys. Rev. A* 70, 063607 (2004).
13. V. Schweikhard, I. Coddington, P. Engels, S. Tung, and E. A.



Cornell, Vortex-Lattice Dynamics in
Rotating Spinor Bose-Einstein Condensates, *Phys. Rev. Lett.*, 89, 210403 (2004).