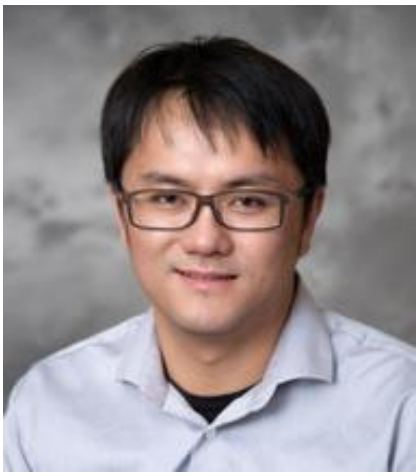
Cold Atom-Nanophotonics Integration: Challenges and New Opportunities



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https://purdue-edu.zoom.us/my/kjurss

Abstract

Integrating cold atoms with nanophotonics opens up promising and scalable quantum applications, ranging from quantum nonlinear optics and quantum networks to sensing and metrology. Achieving neutral atom arrays or ensemble atom trapping on an integrated nanophotonic circuit can enable multiple quantum functionalities within a single optical chip. In this talk, I will discuss the challenges we have overcome in recent years to achieve efficient atom loading, laser cooling, and direct atom trapping on a nanophotonic microring circuit. Additionally, I will discuss novel effects arising from the strong and collective coupling of single to multiple atoms with a nanophotonic resonator. This includes our recent investigations into 'selective radiance,' where an array of atoms super-radiantly couples to a microring resonator while simultaneously becoming sub-radiant to free space, suppressing spontaneous emission through collective destructive interference. Finally, I will discuss potential new quantum applications enabled by this platform.

Bio

Dr. Chen-Lung Hung is currently an associate professor at Purdue's Physics and Astronomy. He received his bachelor's degree in physics from National Taiwan University in 2003 and a Physics PhD at the University of Chicago in 2011, where he developed an in-situ microscopy technique on two-dimensional atomic quantum gases to study quantum phase transitions and nonequilibrium quantum dynamics. Before joining Purdue in 2015 as an assistant professor, he held a postdoctoral fellowship at the California Institute of Technology and developed one of the first photonic crystal atom-photon interfaces for quantum optics. His research directions at Purdue span from studying out-of-equilibrium many-body physics using atomic quantum gases to interfacing ultracold atoms with integrated nanophotonic circuits for quantum network applications and many-body physics with photon-mediated interactions. He is a recipient of the AFOSR Young Investigator Award and the NSF CAREER Award.

Host: Joe Lukens (jlukens@purdue.edu)

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