USC Viterbi School of Engineering
Ming Hsieh Department of Electrical and Computer Engineering

Ming Hsieh Institute **Seminar Series**

Quantum Science & Technology

AMO experiments on a chip: Scalability through integrated photonics in Silicon Carbide and Titanium:Sapphire

Daniil Lukin
Postdoctoral Researcher
Stanford University

Date: Thursday, October 19, 2023
Time: 2:00pm – 3:30pm
In-person: EEB 248

Abstract: A perfect crystal is like a perfect vacuum, in the sense that it admits the propagation of waves without scattering (Bloch waves). It follows that by creating point defects in this "semiconductor vacuum", we can realize eternally-trapped "artificial atoms" (in lieu of suspending atoms in true vacuum as in AMO experiments). These artificial atoms can be straightforwardly integrated into photonic circuits on-chip. It is a highly-attractive proposition in theory, but it has practical challenges. In this talk I will cover the developments of quantum photonics with artificial atoms in Silicon Carbide, and discuss advances in nanofabrication that enabled us to reach the strong-coupling regime between the cavity and artificial atoms. By revisiting the most basic photonic cavity, we combined strong interactions with individual atom addressability to study multi-atom cavity-coupled systems in the solid state. This system is intrinsically scalable, permitting large-scale co-integration of detectors and control lasers. I will discuss the development of the integrated Titanium:Sapphire laser arrays, and scalable control of quantum photonic systems.

Biography: Daniil Lukin did his PhD at Stanford University in the group of Prof. Jelena Vuckovic, where he currently is a postdoctoral researcher. His research interests are in integrated quantum photonics and exploring nanophotonic device nanofabrication for advancing technology and fundamental science.

Hosted by: Quntao Zhang, Wade Hsu, Mengjie Yu, Jonathan Habif & Eli Levenson-Falk