Semiconductor Quantum Technologies for Secure Communications and Scalable Quantum Networks

Abstract: The field of quantum optics offers new ways to compute, communicate, and measure with quantum states. Recent advances in materials, quantum control, and nanofabrication now open the prospect for scalable quantum technologies based on solid-state quantum systems. In particular, photonic integrated circuits (PICs) now allow routing photons with high precision and low loss, and atom-like systems in semiconductors enable spin-based quantum memories that can be coupled to these optical circuits. The first part of this talk will review our recent progress in adapting one of the leading PIC architectures—silicon photonics—for various quantum secure communications protocols. The second part of the talk will consider how PIC technology, integrated with quantum memories, can extend the reach of quantum communications and form the basis of modular quantum computers.

Bio: Dirk Englund received his BS in Physics from Caltech in 2002. Following a year at TU Eindhoven as a Fulbright Fellow, he earned his MS in EE and PhD in Applied Physics from Stanford University in 2008. He was a postdoctoral fellow at Harvard University until 2010, when he became Assistant Professor of E.E. and Applied Physics at Columbia University. He joined the MIT EECS faculty in 2013. Recent recognitions include the 2011 PECASE, the 2011 Sloan Fellowship in Physics, the 2012 DARPA Young Faculty Award, the 2017 ACS Photonics Young Investigator Award, and the OSA's 2017 Adolph Lomb Medal.