Quantum Emission from Hexagonal Boron Nitride

Noah Mendelson

School of Mathematical and Physical Sciences, University of Technology Sydney

CQE IBM Postdoctoral Candidate

February 10, 2021 | 3:00 PM (Central time)

Join Virtually:
https://uchicagogroup.zoom.us/j/96514621827?pwd=TDk5c2xUVXRoWG9mS0w2OVkveHRzQT09

Artificial atomic systems in solids are widely considered a leading candidate for a variety of quantum technologies, including quantum computing, communications, memories, and metrology.The two-dimensional material hexagonal boron nitride (hBN), was first reported to host single photon emitters (SPE) in 2016, and since has attracted a great deal of attention due to its atomically thin nature, ultra-bright emission at room temperature, strong response to applied strain and electric fields (Stark shifts), potential for resonant excitation above cryogenic temperatures, and spin selective optical transitions.

One of the primary challenges in advancing hBN as a quantum optical platform has been the inability to reliably engineer optically active defects in hBN. I will discuss recent advances in the bottom-up growth methods for hBN which enables both the reliable incorporation of optically active hBN defects and simultaneously a route to control their corresponding properties, such as emission energy, SPE density, and spatial localization. Furthermore, such bottom-up growth techniques yield large, centimeter-scale, high-quality hBN films of only a few atomic layers, which has facilitated critical advances in their integration with solid-state and fiber based optical cavities, as well with van der Walls heterostructures. Techniques for tuning the defects through the application of both electric and strain fields will be discussed, demonstrating record energy tuning magnitudes for a 2D SPE source in each case. Finally, I will summarize new investigations into the structural nature of the hBN defects, which suggest the emission to result from a carbon-based defect structure, and recent confirmation of spin selective optical transitions at room temperature.

Noah Mendelson obtained his M.Sc. from the University of California San Diego before pursuing his PhD in physics at the University of Technology Sydney. His research has been focused on studying single photon emission from defects in the 2D material hexagonal boron nitride, including their controlled fabrication, tuning, and integration, as well as studying the structural nature of the defect. Noah was recently awarded the New South Wales Postgraduate Excellence in Physics Award for his PhD work.

Chicago Quantum Exchange promotes academic collaboration and information exchange across the quantum information science community.

Find out more at
quantum@uchicago.edu
chicagoquantum.org
(773) 834-8054