Toward Nanoscale Magnetometry of Van der Waals Heterostructures using Nitrogen-Vacancy Centers in Diamond

THOMAS MITTIGA, SATCHEH HSIEH, CHONG ZU, CHENHAO JIN, JONGHWAN KIM, BRYCE KOBIRN, FENG WANG, NORMAN YAO, Univ of California - Berkeley

Two-dimensional layered heterostructures remain at the forefront of materials research and are promising candidates from the perspective of both fundamental science and technological advancement. They can exhibit a rich array of magnetic phenomena, with recent experiments in transition metal dichalcogenides (TMD) demonstrating long-lived spin relaxation and coherence times. We present first steps toward a wide-field confocal microscope aimed at probing the exciton and defect-based magnetism of such materials. By observing the quenching of fluorescence from single Nitrogen-Vacancy centers of predetermined depths, we measure the transition dipole moment of the TMD and characterize this as a function of layer number. We also describe recent progress toward the imaging of magnetic defects and evaluate the feasibility of using this scheme to probe coupled spin and valley dynamics.

Thomas Mittiga
Univ of California - Berkeley