Tuesday, February 23, 2021
11:30 AM-12:00 PM
Mad City Labs

From iSCAT to SCATTIRSTORM: Adventures in Single-Molecule Microscopy
I will describe the design and application of two multi-modal microscopes built around the Mad City Labs RM21® single molecule microscope. The first system combines Interferometric Scattering (iSCAT) microscopy, developed by Philipp Kukura's lab, together with Total Internal Reflection Dark-Field (TIRDM). By labeling kinesin-1 motors on one head with a 30-nm gold nanoparticle, we were able to track motor stepping at 1 kHz temporal resolution and 1-2 nm spatial precision. This allowed us to clarify previously uncovered features of kinesin stepping. In collaboration with Luke Rice, we extended this system to understanding microtubule dynamics by labeling tubulin dimers with 20-nm gold nanoparticles and observing these tubulin reversibly binding at the plus-ends of growing microtubules. These tools have the potential to be applied broadly to single-molecule studies to increase the temporal resolution beyond what is traditionally accessible by fluorescence, while still maintaining the spatial resolution provided by point-spread function fitting. In the second part of the talk, I will describe our progress on a multi-modal microscope that we are using for a DOE-funded project to study the mechanism of cellulose degradation by cellulases for bioenergy applications. In particular, we have optimized the ability to combine Interference Reflection Microscopy (IRM) to image cellulose micro- and nanofibers with TIRF to simultaneously image fluorescently-labeled cellulase enzymes degrading the cellulose.

Speaker
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