THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

Mathematics Colloquium

October 26, 2023
3:45 - 4:45 p.m.
Phillips Hall 332

Stochastic and continuum modeling of protein polymer dynamics in neurons

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Abstract. Microtubules are protein polymers present in most cells; in neurons, microtubules are believed to be stable and to have specific orientations. This is crucial, since other key proteins get transported along these polarized microtubules, which ensures long-term survival of neurons. But microtubules also need to be dynamic and reorganize in response to injury events. How this balance is achieved remains an open question. Using information from experimental measurements and a stochastic mathematical model, we first seek to understand mechanisms that control microtubule length in dendrites of fruit fly neurons. The modeled mechanisms include limited tubulin availability and the dependence of shrinking events on microtubule length. We also develop a reduced deterministic model that validates and guides our choices of parameters for the more complex stochastic model. Insights from these models of microtubule dynamics can then be used to understand how the microtubule filaments collectively organize into polarized structures in neurons.