Abstract: Nonlocal models have been developed and received a lot of attention in recent years to model systems with important scientific and engineering applications. While it is established that the nonlocal formulations can often provide more accurate descriptions of the systems, the nonlocality also increases the computational cost compared to conventional models based on PDEs. The goal is to combine the accuracy of nonlocal models with the computational and modeling efficiency of local PDEs. In this talk, I will introduce a new self-adjoint, consistent, and stable coupling strategy for nonlocal diffusion models, inspired by the quasi-nonlocal atomistic-to-continuum method for crystalline solids. The proposed coupling model is coercive with respect to the energy norms induced by the nonlocal diffusion kernels as well as the $L_2$ norm, and it satisfies the maximum principle. A finite difference approximation is used to discretize the coupled system, which inherits the property from the continuous formulation. Furthermore, we design a numerical example which shows the discrepancy between the fully nonlocal and fully local diffusions, whereas the result of the coupled diffusion agrees with that of the fully nonlocal diffusion. This work is joint with Dr. Qiang Du from Columbia University, Dr. Jianfeng Lu from Duke University and Dr. Xiaochuan Tian from UTexas, Austin.

Bio: Dr. Xingjie Li is a tenure-track assistant professor at University of North Carolina at Charlotte. Her research lies in the area of applied and computational mathematics, focusing on multiscale modeling and structure-preserving schemes. She has built interdisciplinary collaborations with mathematicians, physicists and engineers in many application problems.