Title: A 'general' formalism for interacting particle PDEs and some challenges in parameter inference

Abstract: In this talk I'll introduce a rather general approach, motivated by statistical mechanics, to describe interacting particles on the PDE level - Dynamic Density Functional Theory (DDFT). I'll first explain how a relatively simple version of (inertial) DDFT can be derived from the underlying Langevin equations for interacting particle dynamics, including highlighting the key assumptions. I'll then briefly describe the main challenges in applying DDFT to real systems, and describe some extensions which significantly increase the generality of the approach. The talk with then focus on some challenges in inferring parameters, and other required quantities, for DDFT models from data. I'll motivate this with two examples from mathematical social science: opinion dynamics and modelling of Covid interventions.