1157-37-198 **Jesse Capecelatro*** (jcaps@umich.edu), 1231 Beal Ave, Ann Arbor, MI 14809, and **Sarah Beetham** (snverner@umich.edu), 1231 Beal Ave, Ann Arbor, MI 14809. *Turbulence modeling of strongly-coupled gas-particle flows using machine learning.*

Many natural and industrial processes involve the flow of solid particles or liquid droplets whose dynamical evolution and morphology are intimately coupled with a carrier gas. A peculiar behavior of disperse multiphase flows are their ability to give rise to large-scale structures (hundreds to thousands of times the size of individual particles), from dense clusters to nearly-particle-free voids. Such coupling can effectively 'demix' the underlying flow, which has enormous consequences in engineering systems. In this talk, high-resolution simulations particle-laden flows will be presented to reveal how multiphase interactions at the particle scale augment or restrict large-scale flow processes, and provide unique insight into the budget of turbulent kinetic energy. A rigorous derivation of the Reynolds-averaged Navier-Stokes equations for coupled fluid-particle flows will be presented, with specific emphasis made on the unclosed terms unique to multiphase systems. In an effort to transform the simulation data into a robust and predictive turbulence model, a new data-driven approach based on sparse regression will be presented. The method will be demonstrated on both single-phase and multiphase flows, with the aim of generating compact, algebraic turbulence closure. (Received January 28, 2020)