1154-55-151 **Chad M. Topaz*** (cmt6@williams.edu). *Topological Data Analysis of Collective Behavior.*

From nanoparticle assembly to synchronized neurons to locust swarms, collective behaviors abound anywhere in nature that objects or agents interact. The study of collective behavior typically involves large data sets generated by experiment and/or simulation. This talk presents topological data analysis (TDA) as an approach for carrying out data science tasks in the context of collective behavior. The key approach is to characterize a system's dynamics via the time-evolution of topological invariants called Betti numbers, accounting for persistence of topological features across multiple scales. First, we use TDA to perform exploratory data analysis on the seminal aggregation model of Vicsek et al. (1995), identifying dynamical events that traditional methods do not. Next, we use TDA to choose between unbiased correlated random walk models of Nilsen et al. (2013) that describe motion tracking experiments on pea aphids. Finally, we investigate parameter recovery in the collective motion model of D'Orsogna et al. (2006). Machine learning methods with inputs derived from topology yield classification accuracy superior to ones with inputs derived from order parameters commonly used in biology and physics. This talk assumes no prior knowledge of topology or machine learning. (Received August 16, 2019)