Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Hidden Markov models for the analysis of single particle trajectories containing multiple mobile states DYLAN YOUNG, JAN SCRIMGEOUR, Clarkson Univ — Single particle tracking offers significant insight into the molecular mechanics that govern the behavior of living cells. The analysis of trajectories that transition between different motive states, such as diffusive, driven and tethered modes, is of considerable importance, with even single trajectories containing significant amounts of information about a molecule's environment and its interactions with structures such as the cell cytoskeleton, membrane or extracellular matrix. Traditional analysis of particle trajectories has relied heavily on evaluation of the mean squared displacement, but often struggles to extract information reliably from small quantities of data or when multiple mobile states are present. Here, we present hidden Markov models for the analysis of complex multi-mobility tracks, focusing on transitions between states exhibiting free diffusion and either driven or tethered motion. The models were tested using simulated trajectories and practical limitations on the track length and state switching probabilities needed for accurate extraction of the physical parameters in the model are identified. These results provide critical information for the design of particle tracking experiments where trajectories containing multiple mobile states are expected.

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Date submitted: 13 Nov 2014 Electronic form version 1.4