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A cycling state that can lead to glassy dynamics in intracellular transport MONIKA SCHOLZ, Univ of Chicago, STANISLAV BUROV, Bar-Ilan University, KIMBERLY L. WEIRICH, BJORN J. SCHOLZ, Univ of Chicago, S.M ALI TABEI, University of Northern Iowa Cedar Falls, MARGARET L. GARDEL, AARON DINNER, Univ of Chicago — Power-law dwell times have been observed for molecular motors in living cells, but the origins of these trapped states are not known. We introduce a minimal model of motors moving on a two- dimensional network of filaments, and simulations of its dynamics exhibit statistics comparable to those observed experimentally. Analysis of the model trajectories, as well as experimental particle tracking data, reveals a state in which motors cycle unproductively at junctions of three or more filaments. We formulate a master equation for these junction dynamics and show that the time required to escape from this vortex-like state can account for the power-law dwell times. We identify trends in the dynamics with the motor valency for further experimental validation. We demonstrate that these trends exist in individual trajectories of myosin II on an actin network. We discuss how cells could regulate intracellular transport and, in turn, biological function, by controlling their cytoskeletal network structures locally.

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