Title:	Collective transport of weakly interacting molecular motors with Langmuir kinetics
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Abstract:	Filament-based intracellular transport involves the collective action of molecular motor proteins. Experimental evidences suggest that microtubule (MT) filament bound motor proteins such as kinesins weakly interact among themselves during transport and with the surrounding cellular environment. Motivated by these observations we study a driven lattice gas model for collective unidirectional transport of molecular motors on open filament. This model incorporates short-range next-nearest-neighbour (NNN) interactions between the motors and couples the transport process on filament with surrounding cellular environment through adsorption-desorption Langmuir kinetics (LK) of the motors. We analyse this model within the framework of a mean-field (MF) theory in the limit of weak interactions between the motors. We point to the mapping of this model with the non-conserved version of the Katz-Lebowitz-Spohn (KLS) model. The system exhibits rich phase behavior with a variety of inhomogeneous phases including localized shocks in the bulk of the filament. We obtain the steady-state density and current profiles, analyse their variation as a function of the strength of interaction and construct the non-equilibrium MF phase diagram. We compare these MF results with Monte Carlo simulations and find that the MF analysis shows reasonably good agreement with simulation results as long as the motors are weakly interacting. For sufficently strong NNN interaction between the motors, the mean-field results deviate significantly, and for very strong NNN interaction in the absence of LK, the current in the lattice is determined solely by the NNN interaction parameter and it becomes independent of entry and exit rates of motors at the filament boundaries.
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