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A study of some non-equilibrium driven models and their contribution to the understanding of molecular motors IRINA MAZILU, JOSHUA GONZALEZ, Washington and Lee University — From the point of view of a physicist, a bio-molecular motor represents an interesting non-equilibrium system and it is directly amenable to an analysis using standard methods of non-equilibrium statistical physics. We conduct a rigorous Monte Carlo study of three different driven lattice gas models that retain the basic behavior of three types of cytoskeletal molecular motors. Our models incorporate novel features such as realistic dynamics rules and complex motor-motor interactions. We are interested to have a deeper understanding of how various parameters influence the macroscopic behavior of these systems, what is the density profile and if the system undergoes a phase transition. On the analytical front, we computed the steady-state probability distributions exactly for the one of the models using the matrix method that was established in 1993 by B. Derrida et al. We also explored the possibilities offered by the "Bethe ansatz" method by mapping some well studied spin models into asymmetric simple exclusion models (already analyzed using computer simulations), and to use the results obtained for the spin models in finding an exact solution for our problem. We have exhaustive computational studies of the kinesin and dynein molecular motor models that prove to be very useful in checking our analytical work.

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