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Multi species asymmetric simple exclusion process with impurity activated flips

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The asymmetric simple exclusion process (ASEP) is broadly regarded as a paradigmatic model for non-equilibrium transport processes. Motivated by a simplistic description of multi lane traffic flow, we present a multi species generalization of ASEP along with impurities where the impurities can activate flips between species, imitating the lane change dynamics in multi lane traffic flow. This model, being disordered and non-ergodic, is of intrinsic interest. The exact non-equilibrium steady state probability distribution is obtained using the technique of matrix product ansatz. Interestingly, for special choice of the microscopic dynamics, the model exhibits negative differential mobility where current can decrease with increasing bias. [arXiv:2205.03082 (2022).]