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Coupled parallel totally asymmetric exclusion processes with extended particles KONSTANTINOS TSEKOURAS, Institut Curie, ANATOLY KOLOMEISKY, Rice University — A complex system consisting of coupled parallel totally asymmetric processes (TASEP) with extended particles is investigated theoretically. Stationary-state properties and phase diagrams are obtained using several approximate methods. We find that the maximum-current phase is very well described by the Tonks gas lattice-based treatment as in the case of the extended-particle single-lane TASEP. However, although the probability balance treatment used in that case for the low and high-density phases yields acceptable results for the low-density phase, it completely fails for the high-density phase in our system. We show that this discrepancy is a result of the coupling and demonstrate that a simple ansatz derived from the single-lane single-particle TASEP restores consistency to the theory. We validate all theoretical predictions via extensive Monte-Carlo simulations: agreement between them and theory is mostly excellent except for the low density/maximum-current phase transition which the theory consistently underestimates. It is shown this disagreement is a result of very slow current saturation with increased exit rate in the relevant region of the phase diagram.

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