[P12] Asymmetric simple exclusion process in one-dimensional chains with long-range shortcuts

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We study the asymmetric simple exclusion process on a one-dimensional chain with long-range shortcuts connecting randomly-selected pairs of sites under the open boundary condition. The resulting lattice structure is similar to that of the small- world network. Our model displays an interesting phase diagram. Numerical simulation results show that there are three phases; the empty phase with $\rho=0$, the jammed phase with $\rho=1$, and the shock phase with $0 < \rho < 1$ where ρ is the overall density. In the shock phase, there exists a localized shock which separates a one-dimensional backbone into a empty region near the entrance and a fully occupied region near the exit. The shock formation is explained by using the mean-field approximation and the annealed approximation.