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Hamiltonian traffic dynamics in microfluidic-loop networks RAPHAEL JEANNERET, DENIS BARTOLO, PMMH-ESPCI, Université Paris Diderot, BARTOLO TEAM — Recent microfluidic experiments revealed that large particles advected in a fluidic loop display long-range hydrodynamic interactions. However, the consequences of such couplings on the traffic dynamics in more complex networks remain poorly understood. In this letter, we focus on the transport of a finite number of particles in one-dimensional loop networks. By combining numerical, theoretical, and experimental efforts, we evidence that this collective process offers a unique example of Hamiltonian dynamics for hydrodynamically interacting particles. In addition, we show that the asymptotic trajectories are necessarily reciprocal despite the microscopic traffic rules explicitly break the time reversal symmetry. We exploit these two remarkable properties to account for the salient features of the effective three-particle interaction induced by the exploration of fluidic loops.

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