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Traffic jams and intermittent flows in microfluidic networks NICOLAS CHAMPAGNE, ROMAIN VASSEUR, ADRIEN MONTOURCY, DENIS BARTOLO, ESPCI ParisTech — We investigate both experimentally and theoretically the traffic of particles flowing in microfluidic obstacle networks. We show that the traffic dynamics is a non-linear process: the particle current does not scale with the particle density even in the dilute limit where no particle collision occurs. We demonstrate that this non-linear behavior stems from long range hydrodynamic interactions. Importantly, we also establish that there exists a maximal current above which no stationary particle flow can be sustained. For higher current values, intermittent traffic jams form thereby inducing the ejection of the particles from the initial path and the subsequent invasion of the network. Eventually, we put our findings in the broader context of the transport proccesses of driven particles in low dimension.

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