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Disorder Induced Transport JOSHUA STEIMEL, TAL KACHMAN, JUAN ARAGONES, ALFREDO ALEXANDER-KATZ, Massachusetts Inst of Tech-MIT — Transport of active or driven particles plays a crucial role in a myriad of processes ranging from biological systems to quantum phenomena. Here we study the transport of active spinning particles in a confined substrate that contains fixed obstacles. Except for a handful of systems, a disordered environment in the form of impurities or obstacles in a material will inhibit transport, and under some circumstances lead to localization. Such phenomena has been directly seen in transport of light in disordered photonic crystals. This is an important question because many vital biological processes depend on the active transport of molecules inside cells and organisms, from molecular motors to cellular transport. In particular, it is vital to know whether disorder leads to the inhibition of transport and localization, or enhances transport. We demonstrate with experiments and simulations that, contrary to intuition, active spinning matter exhibits a disorder-induced delocalization transition dependent on the local order of the obstacles on the substrate. For the regimes studied, we always find anomalous super-diffusive transport that slowly approaches the diffusive regime in the limit of high activity. These results shed light on the effect of hydrodynamic boundary conditions and optimal transport processes in active matter in disordered environments.

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