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Topological hindrance for molecular transport in cylindrical geometries EMANUEL REITHMANN, PATRICK WILKE, ERWIN FREY, Ludwig Maximilian University of Munich — Active molecular transport in biological systems often occurs along cylindrical structures such as microtubules in eukaryotic cells. Based on a driven lattice gas model, we study the effect of a cylindrical geometry on collective motion for multiple species of active particles with distinct directions of motion on the cylinder. We demonstrate that the transport properties of the system strongly differ from transport in one dimension or with a single species only. Our results show that the number of accessible states depends in an intricate way on the particle density due to a complex connectivity of the state space. To quantify this additional topological hindrance, we set up an effective hydrodynamic theory that allows us to predict central observables like the macroscopic particle flux. Further, we develop analytic methods to characterize the phase behavior. These include an exact solution for a new cramming-phase as well as a renormalization approach for low densities.

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