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Topological Mixing in the Vicsek Model of Active Matter
SPENCER SMITH, Mt Holyoke College, NGUYEN NGUYEN, Mount Holyoke College — A general feature of active matter systems is that they consume energy on the small scale and coherent flows emerge on the large scale. Whether the units comprising these systems are bacteria, birds, or the microtubules of active nematics, coherence arises due to local interactions. In a now classic model, the Vicsek model, coherence, as measured by an order parameter, undergoes a phase transition with the changing importance of local interactions. We revisit this result from the perspective of mixing and fluid advection. In particular, we use a measure of dynamic disorder, the topological entropy, which captures the complexity of how the trajectories of these active agents wind about one another. We are able to calculate this mixing measure, and probe the thermodynamic limit of larger ensembles of agents, thanks to a new algorithm, which combines ideas from low dimensional topology and computational geometry. We will show some interesting results in how this disorder parameter behaves as we change the importance of local interactions.

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