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Curvature-induced microswarming and clustering of self-propelled particles[1] ISAAC BRUSS, Univ of Michigan - Ann Arbor, SHARON GLOTZER, Department of Physics, Department of Chemical Engineering, University of Michigan — Non-equilibrium active matter systems exhibit many unique phenomena, such as motility-induced phase separation and swarming. However, little is known about how these behaviors depend on the geometry of the environment. To answer this question, we use Brownian dynamics simulations to study the effects of Gaussian curvature on self-propelled particles by confining them to the surface of a sphere. We find that a modest amount of curvature promotes phase separation by altering the shape of a cluster's boundary. Alternatively, particles on surfaces of high curvature experience reduced phase separation and instead form microswarms, where particles share a common orbit. We show that this novel flocking behavior is distinct from other previously studied examples, in that it is not explicitly incorporated into our model through Vicsek-like alignment rules nor torques. Rather, we find that microswarms emerge solely due to the geometric link between orientation and velocity, a property exclusive to surfaces with non-zero Gaussian curvature. These findings reveal the important role of local environment on the global emergent behavior of non-equilibrium systems.

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