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Swarming and swirling in self-propelled polar granular rods ARSHAD KUDROLLI, Department of Physics, Clark University, Worcester, MA, GEOFFROY LUMAY, GRASP, Physics Department, University of Liège, B-4000 Liège,, DMITRI VOLFSON, LEV TSIMRING, Institute for Nonlinear Science, University of California, San Diego, La Jolla, CA 92093 — We discuss the dynamics of "self-propelled" polar rods experimentally and numerically. In the experiment, the polar motion was achieved by vibrating rods with asymmetric mass distribution. In the numerics, we postulate a driving force acting along the axis of the rod. We observe aggregation of rods at the boundaries because of the inability of rods to turn around and escape for high enough density under low noise conditions. As vibration strength and thus noise is increased, the aggregation reduces and a uniformly distributed state displaying local orientation order and swirls are observed. We observe greater than $\sqrt{n}$ density fluctuations which are in a qualitative agreement with the Toner-Tu model, but this agreement should not be over-emphasized since the model is directly applicable to a nematic regime. Our findings elucidate an important and interesting interplay between the shape and the directed motion in *realistic* self-propelled rods which affects the phenomenology of their collective dynamics.

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