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**Collective dynamics of rigid and deformable self-propelled particles<sup>1</sup>**

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We discuss a series of experiments with granular matter with novel shapes which self-organize upon excitation. Previously, we reported experiments with rigid rod shaped particles with asymmetric mass distributions which show directed motion on a vibrated plate [1]. Recognizing that such a system is a simple physical model of self-propelled particles, we discuss the observed collective behavior such as aggregation at the boundaries and swirling motion in the context of various minimal leaderless models of active living systems such as bacterial colonies and hooved animal herds which show self-organization. We will introduce and discuss the dynamics of deformable shapes consisting of a head and a tail composed of a bead chain which is shown to undergo directed motion because of differential friction associated with the head and the body. [1]: “Swarming and swirling in self-propelled granular rods,” A. Kudrolli, G. Lumay, D. Volfson, and L. Tsimring, Phys. Rev. Lett. 100, 058001 (2008).

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