Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Mechanical adaptation in adhesive bee swarms ORIT PELEG, JACOB PETERS, MARY SALCEDO, LAKSHMINARAYANAN MAHADEVAN, Harvard University — Honeybees often form swarms [1] that take on an inverted cone shape where the bees hold on to each other, and form a large structure that can be hundreds of times the size of a single organism. The mechanism by which a multitude of bees work together, without an overseer, to create a stable structure that defies static gravity and dynamic stimuli (e.g. wind), remains elusive. To test the role of mechanical cues in the swarm morphogenesis, we developed an experimental setup in which mechanical perturbations were applied to a swarm. In response, the bees tuned the aspect ratio of the swarm dynamically toward a wider, more stable, cone. Interestingly, the evolution of the contact area collapsed onto a master curve when plotted vs. number of perturbation events (rather than time), highlighting a possible mechanism by which bees are able to respond to events of sharp force. Indeed, agent-based simulations where individual bees are capable of sensing local mechanical stresses, and respond by changing the global shape of the swarm, are in qualitative agreement with the experimental results. Altogether, our results show how an active, functional structure can respond adaptively to dynamic mechanical loading and share the load by moving into the breach, which might be termed "Mechanical Altruism". [1] T. D. Seeley, Honeybee Democracy, Princeton University Press, 2010

Orit Peleg
Harvard University

Date submitted: 03 Nov 2016 Electronic form version 1.4