Abstract Submitted
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Criterion for noise-induced synchronization: application to colloidal alignment[1] JONAH EATON, New York University, THOMAS A WITTEN, BRIAN MOTHS, University of Chicago — Asymmetric, self-assembled colloidal clusters can rotate stably as they descend under gravity. One may synchronize a dispersion of copies of such a cluster using a force that randomly switches between two different directions[1]. This is an instance of "noise-induced synchronization," demonstrated broadly in dynamical systems that have a stable, periodic motion[2]. When such a system is perturbed by a prescribed transient force, it acquires a phase angle ψ that depends on its initial phase ϕ. For our colloidal dispersion the probability distribution of phases ψ long after a switch in forcing is in general not uniform; thus the entropy H of the ensemble has decreased. The phase map $\psi(\phi)$ provides strong constraints on the change ΔH resulting from a switch: we show that the quantity $< \log |d\psi/d\phi| >$ is an upper bound on $< \Delta H >$. Thus whenever $< \log |d\psi/d\phi| > \ < 0$, H must decrease indefinitely on average. Our simulations show that this average is a good guide to the actual synchronization behavior. This bound and other properties of ΔH apply broadly to any dynamical system with a well-defined $\psi(\phi)$. [1] B. Moths, T. Witten. Phys Rev Lett, **110** 028301 (2013). [2] H. Nakao et al. Phys Rev E, **72** 026220 (2005).

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