Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

**Pattern stabilisation in programmableactive matter** PANKAJ POPLI, PRASAD PERLEKAR, SURAJIT SENGUPTA, TIFR Centre for Interdisciplinary Sciences — Ordered patterns of drones or robotic agents are useful for many purposes such as surveying unknown territory, taking measurements of scientifically important quantities over a large area. Unlike birds, which naturally organise themselves to counteract destabilisation due to a turbulent environment, stabilising a patterned swarm of drones is energetically expensive and requires extensive computation and communication overheads. We propose an energy-efficient algorithm for creating stable, ordered, swarms of active robotic agents arranged in any given pattern. The strategy involves suppressing a class of fluctuations known as non-affine displacements, viz. those involving non-linear deformations of a reference pattern while allowing affine deformations. This is achieved using precisely calculated, fluctuating, thrust forces associated with vanishing average power input. A surprising outcome of our study is that once the shape of the swarm is maintained at a steady-state, the statistics of the underlying flow field is determined solely from that of the a-priori known forces needed to stabilize the swarm. Therefore, such techniques will be useful in studying the turbulent flow where direct measurement of flow velocities is difficult.

Pankaj Popli
TIFR Centre for Interdisciplinary Sciences

Date submitted: 03 Aug 2020 Electronic form version 1.4