Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Propulsion of microparticles in nonlinearly viscoelastic fluids through symmetry breaking[1] LOUIS ROGOWSKI, Southern Methodist University, JAMEL ALI, FAMU-FSU College of Engineering, XIAO ZHANG, Southern Methodist University, HENRY FU[2], The University of Utah, MIN JUN KIM[3], Southern Methodist University — Magnetic micro- and nanoparticles are being utilized in a variety of techniques including hyperthermia, drug delivery, and magnetic resonance imaging. However, the propulsion of spherical microparticles has been limited to a handful of techniques including catalytic propulsion, external magnetic gradients, and geometric functionalization. The research presented here will demonstrate microparticle propulsion through spontaneous symmetry breaking and their control using a combination of static and rotating magnetic fields. Nonlinearities in certain fluids create rod-climbing-like effects that allow rotating microparticles to experience symmetry broken propulsion along their rotation axes. This type of propulsion was demonstrated in several nonlinearly viscoelastic fluids including synthetic mucus and low concentration polyacrylamide. The propulsion direction along the rotation axes were altered by adjusting the magnitude and direction of an overlaid static magnetic field. Several studies were performed including velocity vs. rotational frequency, velocity vs. static magnetic field, particle image velocimetry, and selected 2D and 3D trajectories under both open loop and closed loop control.

[1]National Science Foundation (CMMI: 1712096, 1760642 and 1761060; HRD: 1735968; DMR: 1644779)
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Date submitted: 08 Aug 2020 Electronic form version 1.4