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Experiments using a viscoelastic fluid to beat the Scallop Theorem TONY S. YU, MIT, MAY GICQUEL, Ecole Polytechnique, ERIC LAUGA, UC, San Diego, A.E. HOSOI, MIT — At vanishingly-small Reynolds number, the Scallop Theorem states that a time-reversible or "reciprocal" motion in a Newtonian fluid produces no net force. In principal, a viscoelastic fluid, combined with a reciprocal motion driven at an appropriate frequency—e.g. one that is comparable to the inverse of the intrinsic time scale of the fluid—could break symmetry in the flow and generate propulsion. Here, we present experimental evidence of net flow driven by a low Reynolds number, two-link (one-degree-of-freedom) flapper in a viscoelastic fluid. Particle image velocimetry (PIV) experiments reveal that propulsion has a strong dependence on the Deborah numbers of the flow.

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