Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Feedback between intracellular flow, signaling and active stresses in Physarum plasmodial fragments SHUN ZHANG, University of California at San Diego, ROBERT GUY, University of California at Davis, JUAN CARLOS DEL ALAMO, University of California at San Diego — Physarum polycephalum is a multinucleated slime mold whose endoplasm flows periodically driven by the contraction of its ectoplasm, a dense shell of F-actin cross-linked by myosin molecular motors and attached to the cell membrane. Ectoplasm contractions are regulated by calcium ions whose propagation is in turn governed by the flow. We study experimentally how this feedback leads to auto-oscillation by simultaneously measuring endoplasmic flow speed and rheological properties, the traction stresses between the ectoplasm and its substratum and the distribution of endoplasmic free calcium ions. We find that physarum fragments smaller than 100 microns remain round and stay in place. However, larger fragments break symmetry leading to sustained forward locomotion, in process that is reminiscent of an interfacial instability that seems to settle around two different limit cycles (traveling waves and standing waves). By using different adhesive coatings in the substratum we investigate the role of substratum friction in the emergence of coherent endoplasmic flow patterns and overall physarum fragment locomotion.

Shun Zhang
University of California at San Diego

Date submitted: 01 Aug 2016 Electronic form version 1.4