Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

The coordination between mechanical and chemical subsystems initiates locomotion of 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. 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). We use both theory and experiments to study how coordination emerges between the different mechanical and chemical subsystems of the fragment to initiate locomotion. The role of many involved factors, such as fragment size, substratum adhesiveness, rheological properties, actin polymerization and traction stresses are investigated, and we find they agree well with our predictive model.

Shun Zhang
University of California at San Diego

Date submitted: 01 Aug 2017 Electronic form version 1.4