Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Cytoplasmic streaming emerges naturally from hydrodynamic self-organisation of a microfilament suspension FRANCIS WOODHOUSE, RAYMOND GOLDSTEIN, DAMTP, University of Cambridge — Cytoplasmic streaming is the ubiquitous phenomenon of deliberate, active circulation of the entire liquid contents of a plant or animal cell by the walking of motor proteins on polymer filament tracks. Its manifestation in the plant kingdom is particularly striking, where many cells exhibit highly organised patterns of flow. How these regimented flow templates develop is biologically unclear, but there is growing experimental evidence to support hydrodynamically-mediated self-organisation of the underlying microfilament tracks. Using the spirally-streaming giant internodal cells of the characean algae Chara and Nitella as our prototype, we model the developing sub-cortical streaming cytoplasm as a continuum microfilament suspension subject to hydrodynamic and geometric forcing. We show that our model successfully reproduces emergent streaming behaviour by evolving from a totally disordered initial state into a steady characean "conveyor belt" configuration as a consequence of the cell geometry, and discuss applicability to other classes of steadily streaming plant cells.

Francis Woodhouse
DAMTP, University of Cambridge

Date submitted: 18 Oct 2012 Electronic form version 1.4