Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Towards the rheology of a concentrated array of spherical squirmers TIM PEDLEY, University of Cambridge, TAKUJI ISHIKAWA, Tohoku University, DOUGLAS BRUMLEY, University of Cambridge — Continuum models of dilute suspensions of swimming micro-organisms are well established and can incorporate external (gravitational) forces and torques as well as the particle stress generated by the swimming activity [1]. In a semi-dilute suspension of steady spherical squirmers, hydrodynamic and steric interactions between cells can be computed in a pairwise manner, and Stokesian Dynamics (SD) has been developed for higher concentrations. The stress response to externally applied simple shear has been computed for semi-dilute suspensions [2]. Recently we have examined the stability of a concentrated planar array of identical bottom-heavy squirmers, accounting for cell-cell interactions by the use of lubrication theory [3]. Here we seek to extend this theory to externally driven simple shear, in order to represent the macroscopic shear stress and normal stresses as functions of the shear-rate, the orientation of the applied shear to gravity, and the dimensionless parameters of the squirming motion. Preliminary results are compared with those of a full SD computation. References. [1] Pedley, T.J. & Kessler, J.O. (1992) Ann. Rev. Fluid Mech. 24:313-358. [2] Ishikawa, T. & Pedley, T.J. (2007) J.Fluid Mech. 588:399-435.[3] Brumley, D.R. & Pedley, T.J. (2019) Phys.Rev.Fluids 4:053102

Tim Pedley
University of Cambridge

Date submitted: 30 Jul 2019 Electronic form version 1.4