Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Energy Transport in a Concentrated Suspension of Bacteria TAKUJI ISHIKAWA, NAOTO YOSHIDA, HIRONORI UENO, MATTHIAS WIEDEMAN, YOHSUKE IMAI, TAKAMI YAMAGUCHI, Tohoku University — Coherent structures appear in a concentrated suspension of swimming bacteria. While transport phenomena in a suspension have been studied extensively, how energy is transported from the individual cell scale to the larger meso-scale remains unclear. In this study, we carry out the first successful measurement of the three-dimensional velocity field in a dense suspension of bacteria. The results show that most of the energy generated by individual bacteria dissipates on the cellular scale. Only a small amount of energy is transported to the meso-scale, but the gain in swimming velocity and mass transport due to meso-scale coherent structures is enormous. These results indicate that collective swimming of bacteria is efficient in terms of energy. This study sheds light on how energy can be transported toward smaller wave numbers in the Stokes flow regime.

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Date submitted: 13 Jul 2011 Electronic form version 1.4