Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Cytoskeletal Dynamics and Fluid Flow in *Drosophila* Oocytes[1]
GABRIELE DE CANIO, RAYMOND GOLDSTEIN, ERIC LAUGA, DAMTP, University of Cambridge — The biological world includes a broad range of phenomena in which transport in a fluid plays a central role. Among these is the fundamental issue of cell polarity arising during development, studied historically using the model organism *Drosophila melanogaster*. The polarity of the oocyte is known to be induced by the translocation of mRNAs by kinesin motor proteins along a dense microtubule cytoskeleton, a process which also induces cytoplasmic streaming. Recent experimental observations have revealed the remarkable fluid-structure interactions that occur as the streaming flows back-react on the microtubules. In this work we use a combination of theory and simulations to address the interplay between the fluid flow and the configuration of cytoskeletal filaments leading to the directed motion inside the oocyte. We show in particular that the mechanical coupling between the fluid motion and the orientation of the microtubules can lead to a transition to coherent motion within the oocyte, as observed.

[1]Supported by EPSRC and ERC Advanced Investigator Grant 247333

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Date submitted: 01 Aug 2015 Electronic form version 1.4