Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Oriented suspension mechanics with applications to flow linear dichroism spectroscopy and pathogen detection[1] GEMMA CUPPLES, DAVID SMITH, University of Birmingham, MATTHEW HICKS, Linear Diagnostics Ltd, ROSEMARY DYSON, University of Birmingham — Flow linear dichroism is a biophysical spectroscopic technique that exploits the shear-induced alignment of elongated particles in suspension. This talk is focussed around the broad aim of optimising the sensitivity of this technique by improving the alignment of these particles, with a specific application of a handheld synthetic biotechnology prototype for waterborne-pathogen detection. I will describe a model of steady and oscillating pressure-driven channel flow and orientation dynamics of a suspension of slender microscopic fibres. The model couples the Fokker-Planck equation for Brownian suspensions with the narrow channel flow equations, the latter modified to incorporate mechanical anisotropy induced by the particles. The linear dichroism signal is estimated through integrating the perpendicular components of the distribution function via an appropriate formula that takes the bi-axial nature of the orientation into account. For the specific application of pathogen detection via binding of M13 bacteriophage, I will explore the impact of the channel depth, width, pressure gradient and frequency of oscillations on the alignment in the system. I will also discuss the practical ability for oscillatory flow, compared to steady flow, for the analysis of smaller sample volumes.

[1]This work was supported by a BBSRC Industrial CASE Studentship (BB/L015587/1) and an EPSRC Healthcare Technologies Challenge Award (Rapid Sperm Capture EP/N021096/1).

Gemma Cupples
University of Birmingham

Date submitted: 29 Jul 2019 Electronic form version 1.4