Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Computational modelling of microfluidic capillary breakup phenomena YUAN LI, JAMES SPRITTLES, OCCAM, Mathematical Institute, University of Oxford, JIM OLIVER, Mathematical Institute, University of Oxford — Capillary breakup phenomena occur in microfluidic flows when liquid volumes divide. The fundamental process of breakup is a key factor in the functioning of a number of microfluidic devices such as 3D-Printers or Lab-on-Chip biomedical technologies. It is well known that the conventional model of breakup is singular as pinch-off is approached, but, despite this, theoretical predictions of the global flow on the millimetre-scale appear to agree well with experimental data, at least until the topological change. However, as one approaches smaller scales, where interfacial effects become more dominant, it is likely that such unphysical singularities will influence the global dynamics of the drop formation process. In this talk we develop a computational framework based on the finite element method capable of resolving diverse spatio-temporal scales for the axisymmetric breakup of a liquid jet, so that the pinch-off dynamics can be accurately captured. As well as the conventional model, we discuss the application of the interface formation model to this problem, which allows the pinch-off to be resolved singularity-free, and has already been shown to produce improved flow predictions for related "singular" capillary flows.

Yuan Li
OCCAM, Mathematical Institute, University of Oxford

Date submitted: 30 Jul 2013 Electronic form version 1.4