Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Direct visualization of microalgae rupture by ultrasound-driven bubbles[1] ANGELO POMMELLA, IRINA HARUN, ANTONIS POULIOPOULOS, JAMES J. CHOI, KLAUS HELLGARDT, VALERIA GARBIN, Imperial College London — Cell rupture induced by ultrasound is central to applications in biotechnology. For instance, cell disruption is required in the production of biofuels from microalgae (unicellular species of algae). Ultrasound-induced cavitation, bubble collapse and jetting are exploited to induce sufficiently large viscous stresses to cause rupture of the cell membranes. It has recently been shown that seeding the flow with bubbles that act as cavitation nuclei significantly reduces the energy cost for cell processing. However, a fundamental understanding of the conditions for rupture of microalgae in the complex flow fields generated by ultrasound-driven bubbles is currently lacking. We perform high-speed video microscopy to visualize the miscroscale details of the interaction of *Chlamydomonas reinhardtii*, microalgae of about 10 μm in size, with ultrasound-driven microbubbles of 2-200 μm in diameter. We investigate the efficiency of cell rupture depending on ultrasound frequency and pressure amplitude (from 10 kPa up to 1 MPa), and the resulting bubble dynamics regimes. In particular we compare the efficiency of membrane rupture in the acoustic microstreaming flow induced by linear oscillations, with the case of violent bubble collapse and jetting.

[1]V.G. acknowledges partial support from the European Commission (FP7-PEOPLE-2013-CIG), Grant No. 618333.

Valeria Garbin
Imperial College London

Date submitted: 01 Aug 2015 Electronic form version 1.4