

## Summer Research Program 2011/2012

### *Ultrasonic Particle Manipulator*

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#### Objective

*To manipulate particles within droplets for the purposes of patterning surfaces with biological matter.*

#### Description

When a droplet is excited at an ultrasonic resonance two major effects take place. Both arise from the second order terms in the Navier-Stokes equation. Firstly any particle within the droplet will experience an acoustic radiation force which will act to collect particles at the pressure nodes. Secondly a body force will act on the fluid which will induce acoustic streaming or a bulk swirling flow of the fluid, this in turn will cause drag forces to act on suspended particles. The project will look at bringing particles to certain locations within the droplet using a combination of acoustic radiation forces and streaming induced drag. By doing this patterning can be achieved.

The task will be to develop a device suitable for ultrasonic actuation of a droplet using a bulk transducer, and experimentally investigate methods of achieving the required force fields. It will also be necessary to use computer interfacing to switch between ultrasonic drive signals.

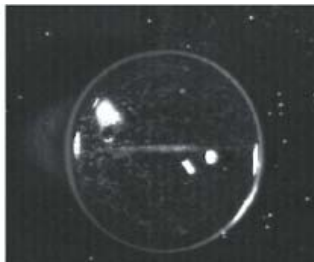


Fig. 1: Collection of particles in a droplet using acoustic radiation forces.



Fig. 2: An example of acoustic streaming causing a 2 micron particle to follow the curved trajectory marked by the black arrow. This sequence of images covers 1.24 secs. In this case the streaming is induced by a 25 micron diameter bubble in an ultrasonic field.