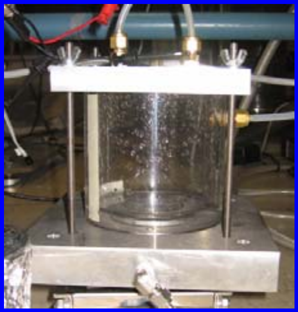

Ultrasonic Atomization Micro-Droplet Project

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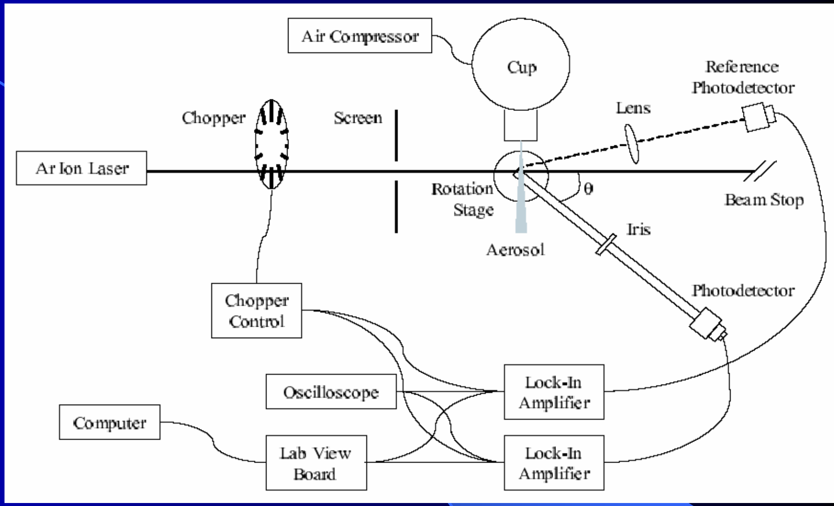
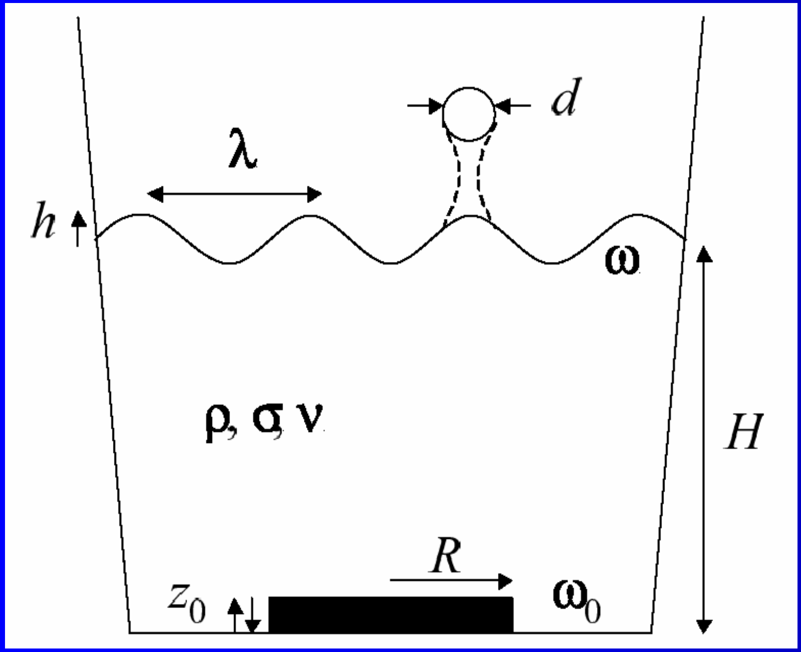
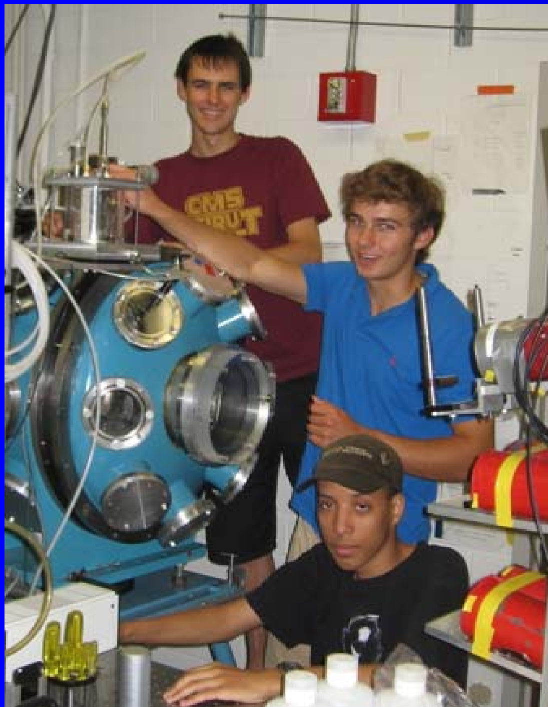


Forcing a piezoelectric ceramic disc to oscillate at high- power and high-frequency, we can drive waves on the surface of a water column such that a peak is created which ejects micro-droplets (see Figure11111). The size of the droplets varies based on the frequency of the piezo.

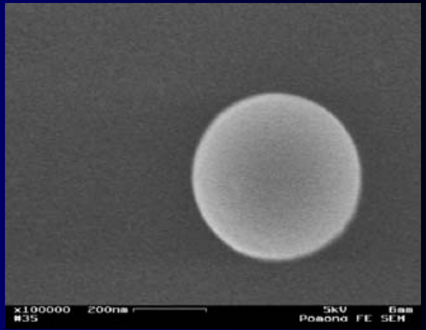


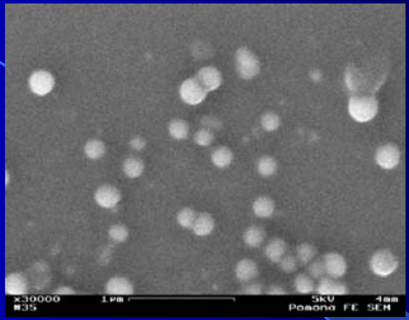
We use a 488nm 3 watt Ar-ion laser to size the droplets using light scattering. Light scattered from the droplets forms a unique pattern for each droplet size, and because of this we can measure scatter to determine droplet size. In our setup, one photodetector is mounted on a swinging arm to measure the droplet scatter at different angles, and another detector sits on a stationary arm to measure a normalizing signal that accounts for variations in droplet density and laser power. A chopper and lock-in amplifiers are used to help alleviate noise problems caused by room lights or other sources. We direct the laser through a column of mist projected by over-pressuring our piezo chamber slightly and aiming it with a small nozzle. In this way light-intensity-vs.-angle data are collected on a computer, and droplets are sized.

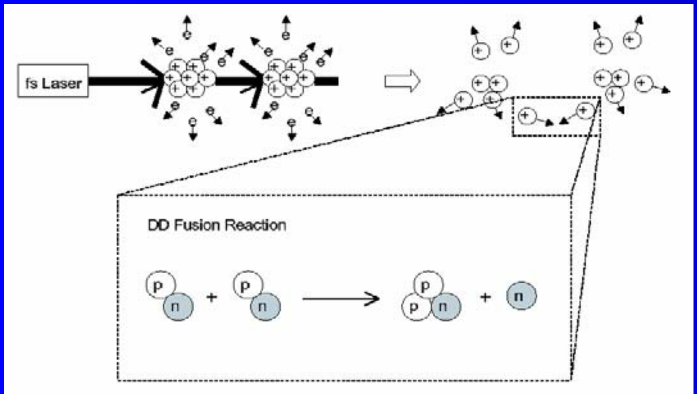
Applications



These droplets can be generated in the optimal size to use as targets for laser-driven fusion experiments with heavy (deuterated) water in place of water. We attempted this while at UT Austin's High Intensity Laser Science Group on the 800nm terawatt THOR laser. Using neutron detectors, we have data which suggests successful fusion.







These droplets can also be used to capture polymers from an aqueous polymer solution. When dried, only the polymer is left behind; they form sphereswhose size is determined by the number of polymers in the droplet. We can control the number of polymers by varying concentration and droplet size.