CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
31820

Project Title
Single Transducer, Gradient-Force Ultrasonic Microparticle Trapping

Abstract

Objectives/Goals
This project investigates a potential method of trapping microparticles (particles with diameter ~100 microns) with high-frequency sound (more specifically, acoustic Bessel beams, which are non-diffractive waves). The project sought to create a special single transducer device that could trap microparticles.

Methods/Materials
Two devices were tested, both of which used the same principles to potentially trap microparticles. The first device was composed of a refractive axicon lens mounted on the surface of a single-element transducer, and the second was a multi-focus Fresnel lens device. The experimental procedure involved placing microparticles- either oil microdroplets or polystyrene microspheres (both types ~100 microns in diameter) into a glass vessel which had either one of the two devices submerged within it. Then, the device would be actuated, and its trapping and manipulating ability observed.

Results
Only the second device, the multi-focus fresnel device, was able to trap and manipulate multiple microparticles on a consistent basis. It consistently captured both oil microdroplets and polystyrene microspheres with an extremely steady hold, and would not release the particles until the device was switched off.

Conclusions/Discussion
The results are unprecedented in that for the first time a single ultrasonic transducer has been shown to consistently trap and manipulate microparticles. This technology could potentially be used to expose individual cells to novel environments to study what the effects would be. In addition, this technology and device could also be used for construction on the micro-scale, of microtechnology devices and so on.

Summary Statement
The project created an ultrasonic device that is capable of trapping and moving around particles of approximately 100 microns.

Help Received
used lab equipment at University of Southern California under supervision of Mr. Choe; USC Machine shop fabricated axicon lens device that I designed; used Fresnel lens device fabricated by Mr. Choe