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Characterizing microbubble interactions with ultrasound using flow cytometry

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Characterizing the fundamental interaction of ultrasound with microbubbles is challenging because of the small spatial and temporal scales. High speed optical imaging is perhaps the most well-known method, as it provides direct information about their response. Although the image is in a plane, the image quality can be sufficient to obtain important information about bubble response. However, high-speed cameras are expensive, data is very limited, and difficult to process. We previously showed how light scattering can be used to obtain similar information - volume oscillations, destruction, even shell properties. Light scattering can be an inexpensive method for probing microbubbles. The difficulties with light scattering (also with optical imaging) are alignment and signal/noise. In this talk we will describe a technique to use commercially-available light-scattering systems to investigate the interaction of pulsed ultrasound with microbubbles. In particular, we developed a technique to insonify microbubbles flowing through the focal region of a flow cytometer. Attached to the quadrature side of a flow cuvette is a small piezoelectric transducer, driven in pulsed mode at various voltages to induce a bubble response. The light scattered from the bubbles can be used for sizing, destruction thresholds, and to assess volume oscillations. Funded by NIH #5R01EB000350