

US course 2023 – Levitator demo exercises

1. Consider a single axis Langevin acoustic levitator consisting of a flat transducer and a flat reflector. The transducer plate vibration was measured in the resonant frequency with Laser Doppler Velocimetry (LDV): peak-to-peak amplitude: 40  $\mu\text{m}$  and frequency: 35 kHz.

Calculate the optimal distance for the reflector and the maximum density of a small spherical sample that still levitates. (Hint: Gor'kov potential)

2. A phased array acoustic levitator consisting of 16 acoustic sources was built. When the sources were positioned at a distance of 5 cm from the levitation spot, the heaviest material that could be levitated was Styrofoam ( $\rho \approx 20 \text{ kg/m}^3$ ).

The next iteration needs be able to levitate a small piece of rock ( $\rho \approx 3000 \text{ kg/m}^3$ ). How many similar transducers are needed (at least), if they cannot be positioned any closer than 10 cm.

(Hint: Gor'kov potential, geometric spread of a point like transducer is inversely proportional to the square of distance  $r$ )