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SINGLE BUBBLE SONOLUMINESCENCE MICROGRAVITY EXPERIMENT DESIGN AND PRELIMINARY RESULTS

Abstract

Sonoluminescence is a process of creating light from sound as a result of acoustic cavitation. A single bubble of air can be trapped in a sound field and made to grow and collapse. On collapse, at a certain driving pressure, a flash of light is produced. This process then repeats and can be made stable for several days. Despite extensive research, the mechanism and source of this light remains a matter of contention.

Use of a microgravity environment offers the potential to explore new avenues in this topic and expand the known parameter space of Single Bubble Sonoluminescence (SBSL). From theory and observation, there are understood to be shape instabilities in the surface of the bubble during collapse. These are due to buoyancy, and thus are driven by gravity. It is expected that in the absence of gravity, the bubble collapse will be more spherical and will allow for SBSL with a larger equilibrium bubble radius and higher driving pressures than is possible under 1g conditions. This experiment has been performed in parabolic flight experiments and SBSL has been achieved with an increase in flash intensity but there has not been development beyond this.

This paper reports the work of a team participating in ESA's Drop Your Thesis 2019 campaign developing a lab-based experiment for use in the ZARM 146 m drop tower. This will be the first time a sonoluminescence experiment will be performed using a drop tower. The aim is to produce SBSL, confirming it is possible in a drop tower environment, and explore expansion of the parameter space. Since the ZARM experiment campaign will take place in November 2019, this paper describes preliminary experiments conducted in a 2.5 m drop box capable of achieving 0.45 seconds of microgravity, the results from these, and the progress in preparation for the 2019 campaign.