New Insights on Antibubbles: Investigation of the Physical Properties of Antibubbles Using an Original Systematic Experimental Setup

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Simply expressed, antibubbles are the material opposite of soap bubbles. They consist internally of a virtually spherical volume of fluid that is separated from the surrounding fluid, typically the same fluid, by a thin layer of air. Due to this composition antibubbles exhibit some physically interesting properties, which can be investigated using fairly simple methods. As part of our project, we use a reproducible experimental set-up to investigate some of the properties of these bubbles. In doing so we also address previously unexplored questions achieving new results in this field of research. For our research we use the so-called “straw method” to generate antibubbles. We were able to fully automate this production method by converting a 3D printer. The video footage was initially analyzed manually using "Tracker". Later we were able to automate the evaluation using Python. Our paper describes the optical characteristics of antibubbles and analyzes the optimal parameters for generating them in terms of a lower limit for the required gravitational energy. We moreover observe the antibubbles’ oscillation that we describe for the first time which comprises two damped oscillations in counter phase, whereby the frequency is dependent on its size. We also investigate the antibubbles' diameter and sink depth as a function of the formation parameters. By considering the forces of the antibubble´s motion we developed a novel approach to calculating the average thickness of the air layer based on the density difference between the antibubble and the surrounding liquid. By using wooden spheres of known density, we were able to test and confirm our approach. Our research thus presents new findings in the field of antibubbles.

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