Paper ID: 59052
student

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Gravity and Fundamental Physics (1)

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ACOUSTIC LEVITATION: PROCESS OF BUILDING AND COMPARATIVE ANALYSIS BETWEEN TWO DIFFERENT ACOUSTIC LEVITATION DEVICES, AND ADAPTATION TO SPECIFIC PRACTICAL APPLICATIONS.

Abstract

The levitation of objects is a phenomenon that has been present throughout the history of a large number of civilizations around the world, and still provokes fascination in today's culture. Acoustic levitation, despite being a relatively recent technique, offers a wide range of possibilities, diversity of experimental conditions and samples. The objectives of this research project are to analyze the acoustic levitation technology from a theoretical and practical point of view and build two acoustic levitation devices, with one and two arrays, respectively, using basic electronics and 3D printed arrays, based on the technique developed by Asier Marzo, Ph. D. in Computer Science at the Public University of Navarra, as well as explore the versatility of the technique through different experiments. The acoustic levitation of particles in devices with two arrays is possible due to the force of acoustic radiation produced by a standing wave. For levitation to occur, the levitated particle needs to be at a distance multiple of half a wavelength. The particles are trapped in the nodes of the standing wave, created by the generated acoustic field, inverting the polarity of the transducers of each array, being the only limitation the size of the sample, which can not exceed half of the wavelength. By testing the devices, it has been proven that the double arrayed levitator was more efficient and could levitate bigger particles and liquids. This one was implemented to be used by Petar Eftimov, Ph. D, at the Department of Cytology, Embriology and Histology at the Sofia University. For that purpose, the size of the particles that can be levitated must have been increased from 4mm diameter to 4.6 mm, which was achieved by using manufactured piezoelectric transducers (328ST16M, Pro-Wave Electronics Corporation). Finally, in relation to the versatility of the technique, it is interesting to consider the possible applications of the device in space experiments, as part of them could be made on Earth, which would suppose cutting the prices, avoiding to send fragile molecules and other type of materials to space. To prove this idea, a selection of experiments from the Nasa website has been made, exposing some of the experiments that can be made with the device: The Binary Colloidal Alloy Test 6: Colloidal Disks (BCAT-6-Colloidal Disks) (Physical Science) Crystallization of Huntingtin Exon 1 Using Microgravity (CASIS PCG HDPCG-1) (Biotechnology) Advancing Membrane Protein Crystallization by Using Microgravity (CASIS PCG HDPCG-2) (Biotechnology)