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Flow Visualization and Acoustic Signal Detection in the Process of Drop Impact on the Surface of a Liquid

V.E. Prohorov

A. Yu. Ishlinski Institute for Problems in Mechanics of the Russian Academy of Sciences, Laboratory of fluid mechanics, Moscow, Russian Federation (prohorov@ipmnet.ru, +7-499-739-9531)

An experimental study of hydrophysical and acoustic phenomena produced by drop falling on the free water surface is of great practical importance with regard to rain intensity measurement and preparation of oceanic acoustic noises model.
Key features of underwater flow associated with an acoustic emission can be revealed in the laboratory experiments under controllable reproducible conditions. The current paper describes the experiments in which the drops detach from a nozzle of 0.4 cm in diameter. The flows impact area is visualized by high speed video camera CR3000$\times$2 whose frame rate varies from 4000 to 20000 fps. Acoustic signals are measured by calibrated hydrophone (bandpass from 2 Hz to 125 kHz) which is synchronized with the video camera by means of special PC interface supplied with multichannel 12-bit AD-convertor. The accuracy of synchronization is supported on the levels 1 μS.
The total acoustic signal produced by drop consists of the initial (impact) pulse followed by one or more resonant sound packets emitted by air bubbles separating from the underwater cavity. Maximal number of packets fixed in the experiments is 4. Comparison of the video- and acoustic data show that resonant packets radiation is strongly timed to the moments of detachment of the air cavity from the underwater cavern formed in the process of absorption of the drop by intaking liquid. The detachment is followed by extremely high accelerations of the underwater cavity tip when it tears off the basic cavern. Acceleration is estimated at level 1000 m/S that matches pressure gradient jump initiated by accelerations is of an order of 10 Pa/m. Detached cavity is initially of irregular form but then turns to regular (elliptic or spherical) shape within some period during which the sound packet is emitted.
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