Lecture 1: Hydrodynamics and acoustics of a drop impact on a fluid

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Modern experimental facility combining high speed video cameras, sensitive hydrophone different optical and contact probes were used to synchronized registration of flows and acoustic effects during detachment, free falling and impact of a singular drop of different liquids on a liquid layer. High resolution photos, video films and sonograms illustrating dynamics and a fine structure of different flow components are analyzed taking into account two classes of processes that are slow large scale mechanical and fast small scale events of an atomic-molecular nature. Processes of energy transformation and substances transport are discussed taking into account mechanical and available surface potential energy and different characteristic time scales of observed phenomena. Mechanism of rapid droplets formation and sound emission during initial contact of the drop with the target liquid is discussed. Secondary sound pulses are emitted by oscillating closed gas cavities which are excited by shock impact in process of its detachment. Pressure impulse is caused by a rapid release of available potential surface energy during a break neck constriction on the bridge linking coming off the cavity with the atmosphere. Environmental impact of drops is demonstrated.

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Lecture 2: **Transport and resuspension of particles in wavy flows**

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A complete classification of periodic i.e. wavy and vortex flows basing on solutions of the fundamental set of non-homogeneous fluid mechanics which contains large and small scale flow components is given. Large scale components describe well-known waves of different types and vortices. Small scale solutions visualize geometry of a fine structure including "traumatic discontinuities" in initially smooth continuous stratification. In suspended flows small scale components act as attractors collecting small particles. Experiments were performed in oscillating rectangular tank with excitation of Faraday's waves. Bottom and a side wall topography causes formation of picturesque fields of the initially uniform suspension concentration visualizing general geometrical features of the tank. Thickness of elongated high concentration interfaces is on order of magnitude of the Stokes scale based on the fluid kinematic viscosity and wave frequency. In vortex flows soluble admixture is transported with formation of long filaments. A transporting solid marker simultaneously swirls around intrinsic axis disturbing local environment. Environmental observations are presented for supplementing of laboratory data.

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