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The Organization and Stability of Bouncing Oil Droplets

Several oil droplets(N=2-4) bounce upon an oscillating surface of the same oil and, at certain frequencies and driving accelerations, interact with each other organizing and clumping together to form “rafts”. The drops in a raft vibrate and “bump” off of each other with distances between the drops falling within a range of values at any given acceleration and frequency. Video captured of the drops (Frequencies = 35Hz-65Hz, Acceleration = 33.25m/s2 – 86m/s2) was analyzed frame by frame to determine the position of each drop in the raft over time. A distribution of distances was calculated from these positions. The average distance of the drops N=2,3,4 were plotted against frequency and driving acceleration. Within a certain number of drops it was observed that average distance was inversely proportional to frequency for instance at F =35Hz, D =14.4509mm (N=2) compared to F =60Hz, D= 4.00267mm (N=2). This same proportionality occurred with driving acceleration. Between different number of drops similar trends appeared with N=2 consistently having higher average distances (although approaching the same values at F=65Hz). The relationship with frequency is attributed to the dispersal relationship for capillary gravitational waves as the predicted data from this model was consistent with the measured values. The inverse relationship between acceleration and distance was refuted by the experiment and is attributed to a loss of energy through vertical motion as a result of larger drops.