LadHyX Seminar – October 9th, 14:00

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Impact of a liquid jet on a plate: from circular hydraulic jump to spray fragmentation

When a liquid jet impacts vertically a horizontal plate, many scenario can occur. In this presentation we will address two of them.

First, the jet impact at room temperature (left image). In that case the liquid will spreads on the plate in a thin liquid sheet. Eventually, at some distance from the jet, the flow will turn into a much deeper liquid film with a much lower speed. The transition between these two regime appears as an almost vertical liquid wall, the so called circular hydraulic jump. Nowadays, the central question on the circular hydraulic jump problem is still: "how can we predict the radius of the circular hydraulic jump knowing the experimental parameters?" and the less we can say is that this question is still not fully solved. Based on experimental measurement and theoretical consideration, we will propose different scaling for the radius and we will particularly highlight the importance of the boundary conditions in this problem. We will also address the question of the exact role of the surface tension in the problem, which is still under debate.

We will also experimentally investigate the case of the impact of a submillimetric water jet on a horizontal surface heated well above the "static" Leidenfrost temperature of water (right image). We will observe the transition from a regime where a single drop grows at the impingement point to a regime of spray formation. We will particularly focus on the second regime, where the liquid jet spreads on the plate, forming a liquid sheet that eventually lifts off and breaks into droplets. We will characterized this regime by the angle of ejection of the droplets. Simple models are then proposed to predict the dependencies and order of magnitudes of the angle of ejection through the establishment of scaling laws.