This work aims to study the impact of a liquid droplet on a liquid pool. Investigation of the influence of fluid properties and impact velocities on Rayleigh jet and pinch-off of secondary droplets is conducted through systematic experiments and computational fluid dynamics (CFD) simulations. The impact of droplets on a deep pool is important due to its association to several applications. Within these applications are: spray cooling, spray painting, inkjet, cleaning up oil spills, etc. Despite the exhaustive research on different aspects of droplet impact, yet it is not clear how liquid properties can affect the instabilities leading to Rayleigh jet breakup and number of secondary droplets formed after its pinch-off. In this study, by means of experiments the droplet impact phenomena is analyzed by changing the physical properties of liquids such as viscosity, density, and surface tension, as well as impact velocities. Further, with assistance of CFD simulations, it is shown that Rayleigh-Plateau instability is influenced by these parameters, while capillary timescale is the appropriate scale to normalize the breakup time. Based on Ohnesorge number (Oh) and impact Weber number (We) a regime map for no breakup, Rayleigh jet breakup, and crown splash regimes is suggested. Interestingly, crown splash is observed to occur at all Ohnesorge number, however, at high Oh, a large portion of kinetic energy is dissipated, thus Rayleigh jet breakup is suppressed regardless of high impact velocity. The normalized required time for the Rayleigh jet to reach its peak varies linearly with the critical height of the jet.

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The public is welcome to attend.