

Microfluidic methods for on-demand manipulation and ejection of picolitre volume droplets

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Droplet based “digital” microfluidics offers a versatile testing platform, confining chemical and biological reactions into tiny aqueous samples. Using such precise miniaturized systems allows significant reduction in reaction times, promising massive increases in throughput as well as reduction in costs. This talk will present recently developed, versatile nanosystems for the automated, on-demand formation and manipulation of pico-to-nano liter volume droplets. In the first part of the talk, I will focus on enclosed systems, in which the droplets are carried in an immiscible oil medium. I will discuss how piezoelectric actuation can be used to instantaneously steer, localize and merge the droplets, and how the droplet volumes and ejection times can be tuned. In the second part, I will discuss how these on-demand capabilities can be combined with X ray compatible devices. Specifically, I will present a new system, which can eject 100-micron diameter droplets into air, on-demand and at a controllable rate.