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Micron-scale droplet deposition from a retreating syringe BIAN QIAN, MELISSA LOUREIRO, ANUBHAV TRIPATHI, KENNETH BREUER, Brown University — Contact drop dispensing is initiated by the formation of a liquid bridge between the substrate and a dispensing syringe. As the syringe retreats, the liquid bridge stretches grows and breaks, leaving a drop on the substrate. The dynamics of liquid bridge breaking have broad interests in crystal growth, inkjet printing and micromanipulation, and contact drop dispensing has many applications in manufacturing and process control. The dynamics of the drop formation are surprisingly complex and the resulting droplet size can vary by orders of magnitude depending on the syringe diameter, d, fluid properties and syringe retraction speed, u. Experiments show that at low retraction speeds, arbitrarily large drops can be formed, their size scaling with $u^{-1/2}$. At a critical speed, the contact line on the substrate reverses direction and shrinks rather than expands as the needle retreats. Above this speed, droplets as small as 50 microns can be formed - much smaller than the characteristic needle dimension ($d \approx 500\mu$m). The limiting droplet size appears to be determined by dynamics of the contact line. We present experimental results and scaling based on measurements over a wide range of physical and geometric parameters.

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