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Planar Microfluidic Drop Splitting and Merging SEAN COLLIGNON, JAMES FRIEND, UCSD, LESLIE YEO, RMIT University, MAD-LAB TEAM — Open drop microfluidic platforms offer attractive alternatives to closed microchannel devices, however, to be effective they require efficient schemes for planar drop transport and manipulation. While there are many methods that have been reported for drop transport, it is far more difficult to carry out drop operations of dispensing, merging and splitting. In this work, we introduce a novel alternative to merge and split drops using laterally-offset modulated surface acoustic waves (SAWs). To do so, the energy delivery into the drop is modulated to induce drop stretching. Upon removal of the SAW energy, capillary forces at the center of the elongated drop drain the capillary bridge region towards both ends, resulting in its collapse and consequential splitting of the drop. This occurs only below a critical Ohnesorge number, a balance between the viscous forces that retard the drainage and the sufficiently large capillary forces that cause the liquid bridge to pinch. By this scheme we show the possibility of both reliable symettric splitting of a drop with an average deviation in droplet volumes of only around 4%, and no greater than 10%, as well as asymmetric splitting, by tuning the input energy to the device—thus presenting a comparable alternative to electrowetting.

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