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Hydrodynamic self-rectification: A novel mechanism for generating uniform static droplet arrays SIVA VANAPALLI, SWASTIKA BITHI, MENG SUN, Texas Tech University — Microfluidic static droplet arrays are a powerful means to simultaneously monitor many biochemical reactions in individual drops. We report a new mechanism for generating exceptionally monodisperse microfluidic droplet arrays. When a train of surfactant-free confined droplets are introduced into a fluidic network with hydrodynamic traps, the droplets are immobilized in the traps due to collective hydrodynamic resistive interactions. In the event, that an immobilized drop either under-fills or overfills the trap, we find that subsequent drops rectify its volume through coalescence, followed by break-up. This self-rectification mechanism thus yields highly monodisperse static droplet arrays. We map the phase space in terms of drop size, spacing and capillary number and find a broad window where this mechanism operates. Because this mechanism alleviates the need to control drop size and spacing in the train to create arrays, we demonstrate its capability to create static arrays with tuneable drop volumes and variable composition.

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