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Deterministic Particle Trapping in Laminar Microvortices ALBERT MACH, DINO DI CARLO, University of California, Los Angeles — We present a method of deterministic trapping of particles larger than a critical size in laminar microscale vortices. This novel phenomenon is observed in microchannels containing a straight channel with periodic expansion and contraction arrays. High fluid flow rates in the laminar regime create a detached boundary layer in each array producing two symmetric fluid recirculation zones. Particles introduced into the straight channel experience two lateral lift forces due to shear gradient and wall effect when inertia is important. As particles approach the expansion, larger shear gradient lift induces larger particles to migrate laterally across streamlines and into the vortex, since the balancing wall-effect lift is no longer significant immediately after the expansion. Smaller particles are maintained in streamlines that flow out of the device because they experience less shear gradient lift–scaling with particle diameter cubed. We identify the hydrodynamic forces responsible for the trapping mechanism, determine the critical particle size for trapping and present potential biological applications in concentrating cells from complex samples using this phenomenon.

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