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Hydrodynamic Trap for Single Cells and Particles[1] MELIKHAN TANYERI, CHARLES SCHROEDER, University of Illinois at Urbana-Champaign — The ability to trap individual particles, cells and macromolecules has revolutionized many fields of science during the last two decades. Several methods of particle trapping and micromanipulation have been developed based on optical, magnetic and electric fields. In this work, we describe an alternative trapping method, the hydrodynamic trap, based on the sole action of hydrodynamic forces in a microfluidic device. A microfluidic cross slot device is fabricated consisting of two perpendicular microchannels where opposing laminar flow streams converge. In this device, a purely extensional flow field is created at the microchannel junction, thereby resulting in a semi-stable potential well at the stagnation point which enables particle trapping. We implement an automated feedback-control mechanism to adjust the location of the stagnation point which facilitates active particle trapping. Using the hydrodynamic trap, we successfully demonstrate trapping and manipulation of single particles and cells for arbitrarily long observation times. This technique offers a new venue for observation of biological materials without surface immobilization, eliminates potentially perturbative optical, magnetic and electric fields, and provides the capability to change the surrounding medium conditions of the trapped object.

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