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Active, Universal Particle Micromanipulators: CPUs for Microfluidics IGOR MEZIC, FREDERIC BOTTAUSCI, UC Santa Barbara, MICRO-NANOSCALE DYNAMICAL SYSTEMS TEAM — Current designs for Lab-on-a-Chip applications consist of a variety of separate microfluidic chambers and channels for functions such as concentration, separation, reaction and mixing of bioparticles in liquids. Here we advance an alternative concept, named μfCPU, the Microfluidic Central Processing Unit, where the key microfluidic operations are performed within a single enclosure, using software-based inputs rather than physical hardware changes, thus emulating the role of the Central Processing Unit in computers and cells in living organisms. We present an experimental embodiment of such a device and describe a variety of microfluidic manipulation tasks achieved in it by the use of a suite of electromotive and fluidic forces in a time-dependent way to produce on-demand functionality. We also discuss a new microfluidic devices architecture that utilizes μfCPU as the basic processing unit and uses centralized pumping instead of integrated microfluidic pumps.

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