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Biochip Levitates Droplets

October 22, 2004

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Researchers from Texas A&M University have devised a way to magnetically levitate particles and droplets that have volumes smaller than one billionth of a milliliter.

Scientists have levitating relatively large objects, including live frogs, using powerful superconducting magnets. The Texas A&M researchers scaled the process down with a computer-chip-size device that contains permanent magnets and 25-micron-wide electrodes. Gaps between the magnets and electrodes oriented perpendicularly to the gaps generate arrays of magnetic wells that can levitate and contain microscopic droplets.

The method, which can move and levitate droplets with a precision of 300 nanometers, has many potential uses, according to the researchers.

It could be used on labs-on-a-chip, and would be able to analyze minuscule amounts of substances using very little of the way of chemicals and power. The magnets and electrodes that make up the device are inexpensive to mass produce, and so could be used in expendable, single-use labs-on-a-chip.

The device could also be used to manipulate droplets, nanoparticles, cells, viruses or even single molecules in conjunction with standard microscopes, and in conjunction with optical tweezers. Optical tweezers move and manipulate extremely small objects using the energy of a laser beam. It could also be used to make multilayered caplets 20 to 50 microns in diameter for programmable drug release inside the body. A micron is one thousandth of a millimeter.

The method could also be used in sensors. Levitated droplets and particles are very sensitive to external forces and could therefore measure them. The method has the potential to be on the order of a magnitude more sensitive to force than any other method at room temperature, according to the researchers.

Prototype levitation devices could be produced within two years, according to the researchers. The work appeared in the September 6, 2004 issue of *Applied Physics Letters*.

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