Trapping and Measuring Charged Particles in Liquids

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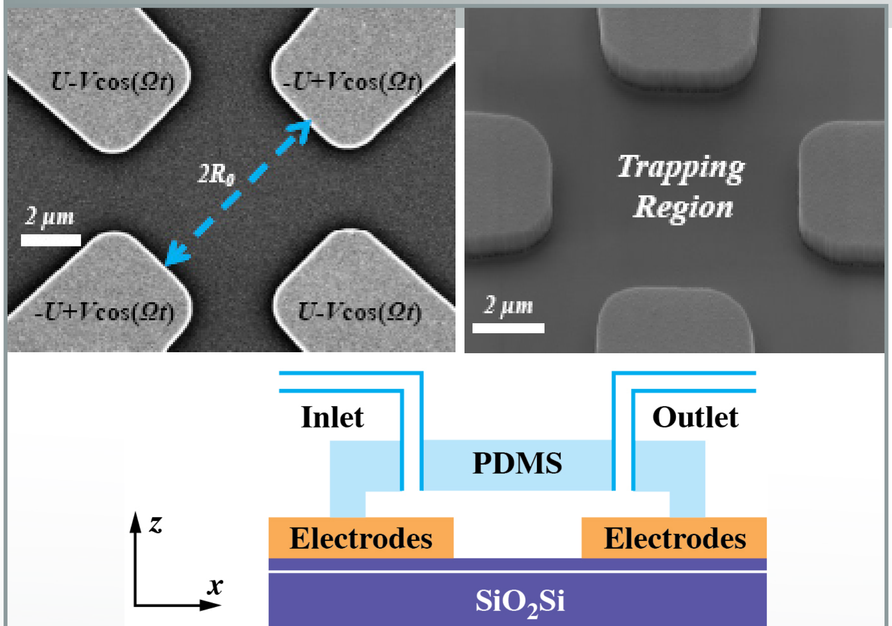

Planar aqueous Paul trap (PAPT) devices and experimental platform.

Technology Summary

A nanoscale version of the Paul ion trap was developed by researchers at ORNL to trap and filter single atomic and molecular ions in liquid environments. Nanoscale control of matter offers an unprecedented means of examining and manipulating biological molecules, ions, polymers, and reactions. Genome sequencing especially benefits from the nanoscale approach.

The trap is a three-layer, three-dimensional crossing metal/insulator structure. Using molecular dynamics simulations, the researchers found that particles are trapped in liquid environments when appropriate AC/DC electric fields are applied to a system. What makes this invention unique is the use of electrical forces to trap charged particles in liquids. The method provides opportunities to study DNA and other molecules with embedded probes while achieving full control of their translocation and localization.

Efficient control of molecules could also be extremely useful in a variety of applications requiring control of the location and movement of ions and molecules. The development of single-molecule nanoprobes has increased the need for a device that can provide such control, since measurement properties of these particles can depend on their geometric conformation in relation to the nanoprobes.

Advantages

- Method for configuring and controlling the motions and positions of charged particles at the nanoscale in liquid environments
- Unprecedented ability to examine and manipulate biological molecules and reactions
- Faster, less costly genome sequencing than existing methods

Potential Applications

- Electronic detection of DNA sequencing to prevent, diagnose, and treat diseases
- High-resolution spatial detection of charged particles in an aqueous environment.

Patent

Mark A. Reed and Predrag S. Krstic, *System and Method for Trapping a Charged Particle in a Liquid*, U.S. Patent Application 12/730,226, filed March 23, 2010.

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