Condensed Matter / Quantum Information Seminar

THURSDAY, OCTOBER 14, 2004

4:00 PM

BROIDA ROOM 3302

SEARCHING THROUGH 50 BILLION CELLS QUICKLY

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The capability to *amplify*, that is, to create multiple copies of a particular DNA through polymerase chain reaction (PCR) has caused a revolution in biotechnology. It has provided the means to detect genetic mutations and pathogenic organisms including viruses and bacteria. In this work, we propose to address an equally fundamental need – the capability to *sort*, that is, to separate and isolate particular molecules, viruses, bacteria and other cells, from a large background of complex mixtures, at very high throughput, purity and efficiency.

In this work, we propose to combine a novel technique of molecular and cellular labeling with Microelectromechanical Systems (MEMS) technology to create a disposable, massively parallel, rare-species sorting system. The physical mechanism is based on dielectrophoresis (DEP) using inhomogeneous AC electrical fields. Our approach is truly unique in two aspects: first, we label the molecules or cells with specifically engineered DEP tags, so that the differences in dielectric constants provide a large force of separation. Second, we leverage the massive parallelism – the hallmark of micro/nano fabrication technology – to create a multi-stage array of sorting chambers to exponentially enhance the performance in throughput, purity, and recovery *simultaneously*.