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Coherent Particle Scattering ERIC CUMMINGS, Sandia National Laboratories — The concept and modeling of coherent particle scattering (CPS) are presented. CPS is transport that arises from interactions of molecules with periodic, spatially non-uniform fields. CPS supports a variety of novel micro- and nanofluidic technologies including coherent nonlinear chromatography (CNC). CNC is a novel separation technique that promises ultra-rapid sorting of particles and molecules. Employing interactions with field nonuniformities in the bulk suspending fluid, CNC avoids chromatography's reliance on repeated diffusion of particles to and from surfaces and can theoretically separate protein-scale molecules greater than 100,000X faster than conventional chromatography. CPS transport is a particle-specific secondary flow produced when particles interact with periodic field nonuniformities. These nonuniformities can be created by macromolecular self-assembly or lithographic patterning. The spatial arrangement of non-uniformities and type of applied field controls the nature of CPS. The term "coherent" in CPS and CNC refers to spatially coherent patterning that can rapidly drive and linearly "amplify" transport effects. Specific examples of CPS based on dielectrophoresis, electrokinesis, and entropic effects are detailed.

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