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Accurate predictions of dielectrophoretic force and torque on particles with strong mutual field, particle, and wall interactions[1] QIANLONG LIU, KENNETH REIFSNIDER, DOE Energy Frontier Research Center, University of South Carolina — The basis of dielectrophoresis (DEP) is the prediction of the force and torque on particles. The classical approach to the prediction is based on the effective moment method, which, however, is an approximate approach, assumes infinitesimal particles. Therefore, it is well-known that for finite-sized particles, the DEP approximation is inaccurate as the mutual field, particle, wall interactions become strong, a situation presently attracting extensive research for practical significant applications. In the present talk, we provide accurate calculations of the force and torque on the particles from first principles, by directly resolving the local geometry and properties and accurately accounting for the mutual interactions for finite-sized particles with both dielectric polarization and conduction in a sinusoidally steady-state electric field. Since the approach has a significant advantage, compared to other numerical methods, to efficiently simulate many closely packed particles, it provides an important, unique, and accurate technique to investigate complex DEP phenomena, for example heterogeneous mixtures containing particle chains, nanoparticle assembly, biological cells, non-spherical effects, etc.

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