Abstract Submitted
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**Directly resolving particles in an electric field: local charge, force, torque, and applications**[1] QIANLONG LIU, DOE Energy Frontier Research Center, University of South Carolina — Prosperetti's seminal Physalis method for fluid flows with suspended particles is extended to electric fields to directly resolve finite-sized particles and to investigate accurately the mutual fluid-particle, particle-particle, and particle-boundary interactions. The method can be used for uncharged/charged dielectrics, uncharged/charged conductors, conductors with specified voltage, and general weak and strong discontinuous interface conditions. These interface conditions can be in terms of field variable, its gradients, and surface integration which has not been addesed by other numerical methods. In addition, for the first time, we rigorously derive the force and torque on the finite-sized particles resulting from the interactions between harmonics. The method, for the first time, directly resolves the particles with accurate local charge distribution, force, and torque on the particles, making many applications in engineering, mechanics, physics, chemistry, and biology possible, such as heterogeneous materials, microfluidics, electrophotography, electric double layer capacitors, and microstructures of nanodispersions. The efficiency of the method is demonstrated with up to one hundred thousand 3D particles, which suggests that the method can be used for many important engineering applications of broad interest.

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