Abstract Submitted
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The Polarization of Nanorods Submerged in an Electrolyte Solution and Subjected to an AC Electric Field[1] HUI ZHAO, University of Nevada, HAIM BAU, University of Pennsylvania — Recently, there has been a growing interest in utilizing electric fields to position and separate rod-shaped particles such as DNA molecules, actin filaments, and nanorods. The polarization of the electric double layer enveloping the rod plays a critical role in determining the magnitude and direction of the rod's dipole moment. We calculate the dipole moment as a function of the electric field frequency, the rod's aspect ratio (length/radius), the rod's free surface charge, and the double layer's thickness. To this end, we solve the Poisson-Nernst-Planck equations for the ions' migration, diffusion, and convection. When the surface charge is small and the rod is short, the dipole moment is negative. As the rod's length increases, the dipole moment increases, and eventually changes sign from negative to positive. The dipole coefficient of rods, whose length is greater than some critical value, increases linearly with length. The theoretical predictions are compared and favorably agree with experimental data for short DNA molecules.

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