Shear Viscosity of Dense Polar Fluids

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Transport properties of fluids with electrostatic interactions are theoretically challenging, even just for bulk fluids, because the long-range interactions preclude the use of a simple effect-diameter approach based solely on hard spheres. We develop an analytical approach to the viscosity of a polar fluid that incorporates electrostatic interactions. We develop a kinetic theory for dipolar hard-sphere fluids that is valid up to high density and use it to obtain the shear viscosity. We also perform molecular-dynamics simulations of this system and extract the shear viscosity numerically. The theoretical results compare favorably to the simulations. I will also show some preliminary simulation results for viscosity in external fields.

References: Phys. Rev. Lett. 124, 218004 (2020)