Abstract Submitted
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Viscosity of strongly-coupled dusty plasmas in a liquid state[1] J. GOREE, Dept. of Physics and Astronomy, The Univ. of Iowa, Z. DONKÓ, P. HARTMANN, K. KUTASI, Research Institute for Solid State Physics and Optics, Budapest, Hungary — Dusty plasmas, consisting of micron-size polymer spheres that are electrically charged and suspended in a glow-discharge plasma, provide a convenient experimental way to make a strongly-coupled plasma. Experimenters can configure the confinement so that the particles fill a 1D, 2D, or 3D space. Experimenters can observe particle motion directly using video microscopy, and they can manipulate particles using lasers to create, for example, a shear flow. Recent experimental measurements of the viscosity transport coefficient in a 2D monolayer dusty plasma, which we will review, led us to perform 2D non-equilibrium molecular-dynamics simulations with a Yukawa potential. We found that, as with 3D Yukawa and OCP liquid-state strongly-coupled plasmas but unlike most simple liquids, the viscosity has a minimum value at a particular temperature, corresponding to $\Gamma \approx 20$. Our most significant result is that we detected shear thinning, i.e., the viscosity diminishes as the velocity shear increases. This non-Newtonian fluid property was discovered using a method to measure separately the effects of temperature and shear rate on the sheared velocity profile; this method will also be useful in future experiments.

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