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Viscoelacticity of Water in Sub-nanometer Gaps[1] TAI-DE LI, ELISA RIEDO, School of Physics, Georgia Tech, SCHOOL OF PHYSICS, GEORGIA TECH TEAM — Direct and simultaneous measurements of the normal and lateral forces encountered by a nanosize spherical silicon tip approaching a solid surface in purified water are reported. For tip-surface distances, $0 \pm 0.03\text{nm} < d < 2\text{nm}$, experiments and grand canonical molecular-dynamics simulations find oscillatory solvation forces for hydrophilic surfaces, mica and glass, and less pronounced oscillations for a hydrophobic surface, graphite. The simulations reveal layering of the confined water density and the development of hexagonal order in layers proximal to a quartz surface. For subnanometer hydrophilic confinement, the lateral force measurements show orders of magnitude increase of the viscosity with respect to bulk water, agreeing with a simulated sharp decrease in the diffusion constant. No significant viscosity increase is observed for hydrophobic surfaces.

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