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Effective Viscosity of a Dilute Suspension of Membrane-bound Inclusions MARK L. HENLE, ALEX J. LEVINE, Department of Chemistry and Biochemistry, University of California, Los Angeles — In 1906, Einstein famously calculated the effective viscosity of a dilute solution of spheres suspended in a viscous solvent [*Annalen der Physik* **19**, 289 (1906)]. In this talk, we consider the two-dimensional analogue of this problem: that is, we calculate the effective viscosity of a dilute suspension of disks embedded in a two-dimensional fluid membrane. The rheological properties of particle-decorated membranes and fluid-fluid interfaces are important in a variety of soft matter systems. For example, the cell membrane contains a suspension of membrane-bound inclusions (e.g. transmembrane proteins, lipid rafts), which modifies the transport kinetics of the membrane. Also, the interfacial viscosity of liquid-liquid interfaces in colloid-stabilized emulsions plays a key role in preventing droplet coalescence. We include the dissipation caused by flows both within the membrane and in the surrounding bulk fluids. When the flows within the membrane dominate the dissipation, the particle suspension effectively shifts the membrane viscosity. Conversely, when flows induced in the bulk fluids dominate the dissipation, the suspension in the membrane shifts the bulk viscosity. In both limits, we obtain simple analytic expressions for the appropriate effective viscosity.

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