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Particle sedimentation in a sheared viscoelastic fluid[1] WILLIAM L. MURCH, SREENATH KRISHNAN, ERIC S. G. SHAQFEH, GIANLUCA IACCARINO, Stanford University — Particle suspensions are ubiquitous in engineered processes, biological systems, and natural settings. For an engineering application – whether the intent is to suspend and transport particles (e.g., in hydraulic fracturing fluids) or allow particles to sediment (e.g., in industrial separations processes) – understanding and prediction of the particle mobility is critical. This task is often made challenging by the complex nature of the fluid phase, for example, due to fluid viscoelasticity. In this talk, we focus on a fully 3D flow problem in a viscoelastic fluid: a settling particle with a shear flow applied in the plane perpendicular to gravity (referred to as orthogonal shear). Previously, it has been shown that an orthogonal shear flow can reduce the settling rate of particles in viscoelastic fluids. Using experiments and numerical simulations across a wide range of sedimentation and shear Weissenberg number, this talk will address the underlying physical mechanism responsible for the additional drag experienced by a rigid sphere settling in a confined viscoelastic fluid with orthogonal shear. We will then explore multiple particle effects, and discuss the implications and extensions of this work for particle suspensions.

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