Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Immersed Particle Dynamics in Fluctuating Fluids with Memory
CHRISTEL HOHENEGGER, University of Utah, SCOTT MCKINLEY, University of Florida — Multibead passive microrheology characterizes bulk fluid properties of viscoelastic liquids by connecting statistically measurable quantities (e.g. mean-square displacement, auto-correlation to mechanical fluid properties (loss and storage modulus). Understanding how these material properties relate to biological quantities (e.g. exit time, first passage time through a layer) is of crucial importance for many pharmaceutical and industrial applications. To correctly model the correlations due to the fluid's memory, it is necessary to include a thermally fluctuating stress in the Stokes equations (Landau and Lifschitz 1958). We present such a model for an immersed particle passively advected by a fluctuating Maxwellian fluid. We describe the resulting stochastic partial differential equations for the underlying non-Markovian, stationary fluid velocity process and we present a covariance based numerical method for generating particle paths. Finally, we apply standard experimental one and two-point microrheology protocol to recover bulk loss and storage modulus and quantify the resulting errors. Our approach can be applied to a Stokes fluid with memory created by a large suspension of active swimmers or to the diffusion of a particle in a crowded environment.

Christel Hohenegger
University of Utah

Date submitted: 01 Aug 2014 Electronic form version 1.4