Viscoelasticity in (Nearly) Two Dimensions

The interfaces separating bulk fluids, whether they occur in nature or encountered in technological applications, are very often populated by surface active species can render them viscoelastic. Prominent examples include the tear film of the eye where complex phospholipid mixtures (the meibum) stabilize this thin film against dewetting, monoclonal antibody solutions where absorptive layers are the precursors to unwanted aggregation phenomena, and asphaltenes that inhibit coalescence within water-in-oil emulsions. This lecture will explore these applications and demonstrate the connection of interfacial viscoelasticity to the underlying physics.

Applications where interfacial rheology is important most often involve thin liquid films where fluid mechanical boundary conditions are modified to account for the ability to support shear and dilatational stresses. Consequently, studies of such processes must combine experimental methods with the capability of following the dynamics of thin films undergoing flow with the development of new interfacial rheometers. This presentation will introduce two new instruments, the interfacial drainage and dewetting optical platform (i-DDrOP) and the dynamic fluid film interferometer (DFFI) to accomplish the former requirement. Interfacial rheological characterization is accomplished by several techniques developed in the Fuller laboratory: the interfacial stress rheometer, the double wall ring, and the dilating drop.

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