Multi-component Fluids near Interfaces: Dynamics Across Length and Time Scales

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Presence of complex solutions composed of fluids, ions, surfactant molecules, and colloidal particles is commonplace in problems relevant to materials discovery and manufacturing. Such multicomponent fluidic systems are often confined by interfaces in processes associated with the water-energy nexus as well, for example, in membrane separations and subsurface energy recovery and storage. To make matters more intricate, fluid interfaces are not static and are constantly subject to external disturbances such as thermal gradients, imposed stresses, and changes in composition. Given the environmental and economic impact of the subject matter, it is important to advance our fundamental quantitative understanding of the complex interfacial systems just summarized, with the goal of ultimately predicting and controlling their behavior in relevant high-tech applications. In this talk, Prof. Razavi will review recent findings in her group on how particle attributes such as wettability and surface anisotropy influence the stability and rheology of fluid interfaces. In particular, she will discuss the impact of particle surface properties on the interfacial microstructure and flow behavior, and their connection to the performance in resulting Pickering foams. To complement the experimental observations, Prof. Striolo will illustrate approaches implemented in his group to interpret the behavior of particles at interfaces, flat and curved, as well as to design advanced chemicals, active on these surfaces, for controlling the outcome of applications in the energy and environmental sectors.