Diffusiophoresis (DP) and chemotaxis (CT) have fundamentally different origins: DP refers to the
deterministic motion of a larger (living or non-living) species induced by the concentration
gradient of a smaller chemical species via electrokinetic interactions, whereas CT refers to an
analogous deterministic motion but generated by the biological response of the larger, living
species. Spanning across the organic and inorganic regimes, DP and CT underlie a wide array of
applications from enhanced oil recovery to guided drug delivery and are principle mechanisms for
microorganisms seeking favorable environments for survival. Bridging these two seemingly
unrelated mechanisms is the compressible flow of the larger species (referred to as colloids in the
following) induced by the spatially varying chemical concentration (referred to as solute). In this
talk, I present a novel, unifying framework which models DP and CT of colloids under the
influence of applied hydrodynamic flows. I present three key findings central to leveraging
hydrodynamic flows for tailoring and characterizing the transport of DP and CT colloids. First,
contrary to the notion to use hydrodynamic flows to enhance colloid motion, I reveal that
hydrodynamic flows could reduce the translation and spreading of DP and CT colloids. This
phenomenon is a consequence of hydrodynamic flows smearing out the solute gradient, thus
weakening the DP and CT motion compared to that in the absence of hydrodynamic flows.
Second, I predict new regimes of anomalous spreading of colloids, namely sub- and super-
diffusion, which match qualitatively with experiments and can be tuned by hydrodynamic flows.
In closing, I discuss how these novel transport phenomena offer transformative solutions to
enhance and innovate applications that involve colloid delivery, extraction, and sensing.

Biography: Henry Chu is an assistant professor in the Department of Chemical Engineering at
University of Florida (UF). He obtained a M.Phil. in mechanical engineering from The
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UF. The theme of his research is heterogeneous soft matter transport and design, covering topics
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emerging NAE Grand Challenges for Engineering in these research areas, emphasizing on close
collaboration with experimental groups to translate knowledge into applications. His work has
been recognized through several awards, including Mechanical Engineering Outstanding
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Scholarship (Cornell). Apart from classroom teaching, he enjoys interacting with students in
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