Invited Talk (AIMR-INSPIRE)

Nanoparticle Artificial Molecules, Plasmon-Coupled Spectroscopy, and Unwonted Dynamics

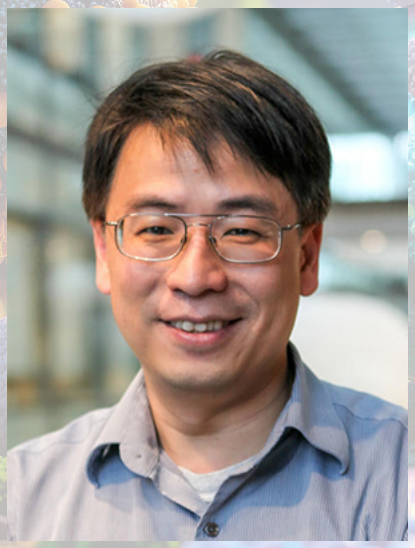
Prof. Haw Yang (Department of Chemistry, Princeton University)

January 5 (Mon.), 2026

14:00-15:00

Seminar Room (AIMR 2F)

The nanoscale—the size range between molecules and bacteria that remains a challenge for quantitative characterization—is rich in structural and functional phenomena. This seminar outlines recent advances from the Princeton complex-system dynamics lab addressing these challenges. We discuss how DNA-valency sorting creates "artificial atoms," advancing the concept of "artificial molecule chemistry."



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Haw Yang received his Ph.D. from the University of California at Berkeley and was a Postdoctoral Fellow at Harvard University. He is currently a Professor of Chemistry at Princeton University. His research focuses on chemical dynamics in complex systems, bridging physical chemistry, materials biology, and biophysics.

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Abstract

There exists rich structural and functional phenomena for objects comprised of materials and biological components in the length scale regime between a typical molecule and a common bacterium (e.g., *Escherichia coli*, sized ~500 nm by ~1 μm). Yet, this is also a challenging length scale which continues to defy quantitative studies using conventional approaches. In this presentation, we will discuss recent advances made in the Princeton complex-system chemical dynamics lab that address some of the challenges pertaining to nanoscale structure, function, and dynamics. Structurally, we discuss how "artificial atoms" created using the DNA-valency sorting technology could be an important step closer to the full realization of the "artificial molecule chemistry" as envisioned 30 years ago. Functionally, we focus on the optical signals that could be enhanced (or quenched) by plasmonic nanoparticles, and discuss why all five known theoretical models are inadequate to fully describe plasmon-coupled spectroscopy. We finish the functions discussion with a new theoretical model that is quantitatively supported by experiments. For the final topic, nanoscale dynamics, we illustrate how innovative experimental approaches help to advance basic science in colloidal and non-equilibrium physics.