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Supercavitating Plasmonic Nanoparticles

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Date: Tuesday, 28th June, 2022 17:00-18:00

Venue: Faculty of Engineering Bldg. 2, Room 212／Online (hybrid)

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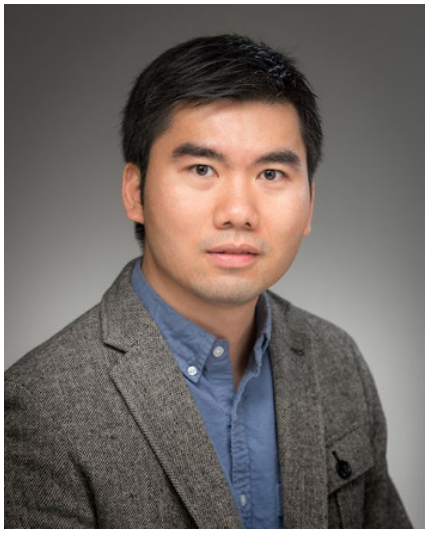
Abstract:

The field of plasmonic nanobubbles, referring to nano-sized bubbles generated around nanoparticles (NPs) due to plasmonic heating, is growing rapidly in recent years. When NPs are encapsulated by such plasmonic bubbles, we call them supercavitating NPs. In this talk, I will highlight our recent research findings around the topic of supercavitating NPs. We show that the unique NP-in-nanobubble configuration can lead to interesting dynamics of the NP under optical excitation. Specifically, we demonstrate the ability to drive NPs to unprecedented speeds (~397,000 $\mu m\ s^{-1}$) using a laser beam by its applied optical forces. Interestingly, the optical forces from a single laser beam can not only push the NPs forward but also pull it backward, both with high speeds. We elucidate the underlying mechanism for such observations and show how it can enable other interesting phenomena like ballistic Brownian motion and NP deposition. We also show that the light-driven NP deposition on a transparent substrate is responsible for laser-induced surface bubble nucleation. Such plasmonic surface bubbles can collect suspended molecules in the liquid and accumulate them at the three-phase contact line of the bubble. We show that this feature of surface bubbles can be leveraged for sensing applications.



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