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University of Miami, Physics Department Seminar

Date: Wednesday, January 14th, 2026
Time: 11:00 am – 12:00 pm
Location: Room 105, Knight Physics Building

Flow generation and droplet fragmentation at biological interfaces during impacts

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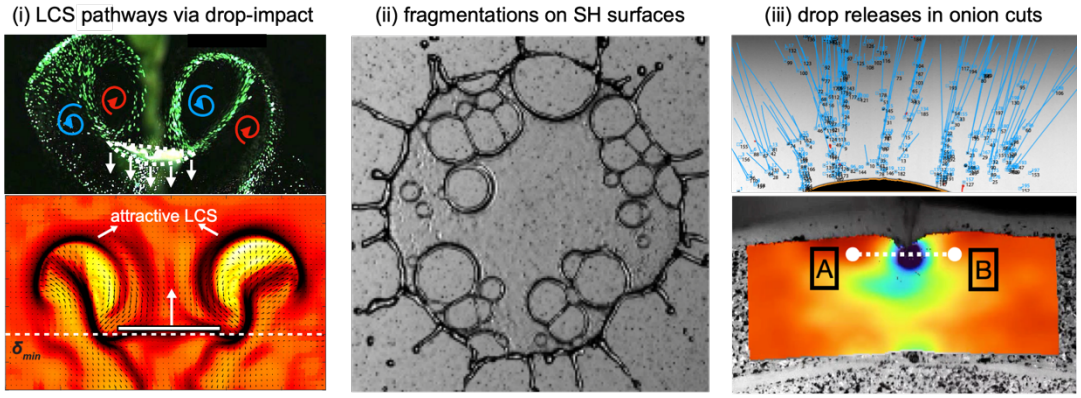

Abstract: Interactions between organisms and their surrounding fluid environments (water currents, air eddies, rainfall, etc.), inevitably involve immediate contacts on complex biological substrates (e.g., bird feathers, insect wings, plant leaves, etc.). Input of kinetic energy in such systems often induce rich dynamical interplay coupling the flow and fluid deformations to the soft substrate surface/bulk properties. In this talk, the fluid phenomenon of drop-flow generation and droplet fragmentations (subdivisions of fluid filaments) are inspected in three distinct biological impact systems: (1) streaming flow near leaves generated by raindrop impacts, (2) fragmentation of raindrops upon impingement on architectured superhydrophobic (SH) surfaces, (3) fragmentation of droplets during onion cutting. The three systems are rationalized via experiments and theories to establish how substrate surface and body properties, such as elasticity and surface topography, mediate the flow characteristics at varying regimes of inertial and capillary forces during impacts. As a result, it can be shown that raindrops trigger hidden Lagrangian coherent pathways for spore dispersion, bumpy SH surfaces trigger raindrop rapid shedding mechanistically aiding organismal protection, and cutting parameters directly dictates the lachrymatory droplet releases in onions, with applicable insights in tuning biological and culinary flow outcomes via the mediating substrates.

Biography: Dr. Brian Wu is a postdoc, currently working at Syracuse University with Dr. Anupam Pandey on fluid-soft structure interactions. He received his PhD in Mechanical and Aerospace Engineering, under the mentoring of Prof. Sunghwan Jung at Cornell University. His work primarily focused on fluid flow interactions at biological interfaces during PhD. He obtained his BS in Materials Science and Engineering, UIUC, with experiences in active matter self-assembly as well. He is interested in exploring information encoding via fluid and soft body interactions in future.