JNNFM-JoR-RA Seminar Series, Wednesday 15th January 2025, 11.00AM Houston time

Bubble Dynamics and Foam Rheology in Confined Geometries

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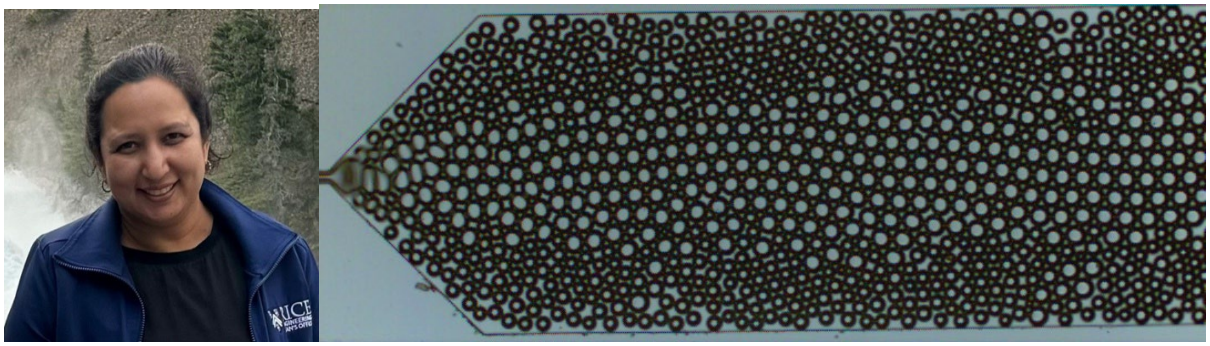

The rheology of foam plays a crucial role in various industrial applications and understanding the complex physicochemical processes governing foam behavior in confined geometries is essential for predicting their flow in natural environments. I will describe how close confinement of bubbles can facilitate neighbor-neighbor bubble pinch-off, where the strong interactions of two or more bubbles break a central elongated bubble. This “structure-induced capillary instability” elucidated the process of bubble breakup in sheared foams, leading to new pore-level mechanisms of foam generation in porous media. I will also describe an expansion-channel microfluidic device for production of ordered, bi- or tri-disperse foams at capacities exceeding thousands of daughter bubbles per second. Pinch-off is systematic at sufficiently large strain rates, assisted by a clear templating effect from the bubbles in the expansion. The relationship between the capillary number, the upstream shear rate, and the size distribution of fragmented bubbles will be discussed. The banded size segregation of fragmented and intact bubbles is primarily governed by the channel geometry, and these bubble crystals show interesting deformation dynamics as they flow through channels with periodic boundaries.