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Non-regular behavior during the coalescence of liquid-like cellular aggregates

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Abstract:

The fusion of cell aggregates widely exists during biological processes such as development, tissue regeneration, and tumor invasion. Cellular spheroids (spherical cell aggregates) are commonly used to study this phenomenon. In previous studies, with approximated assumptions and measurements, researchers found that the fusion of two spheroids with some cell type is similar to the coalescence of two liquid droplets. However, with more accurate measurements focusing on the overall shape evolution in this process, we find that even in the previously-regarded liquid-like regime, the fusion process of spheroids can be very different from regular liquid coalescence. We conduct numerical simulations using both standard particulate models and vertex models with both Molecular Dynamics and Brownian Dynamics. The simulation results show that the difference between spheroids and regular liquid droplets is caused by the microscopic overdamped dynamics of each cell rather than the topological cell-cell interactions in the vertex model. Our research reveals the necessity of a new continuum theory for "liquid" with microscopically overdamped components, such as cellular and colloidal systems. Detailed analysis of our simulation results of different system sizes provides the basis for developing the new theory.

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Time:
9:00 AM-10:15 AM (PT)
12:00 PM-1:15 PM (ET)

About the speaker:

Dr. Haicen Yue is a postdoctoral fellow in Physics at Emory University interested in the underlying, universal mechanisms and theories for different collective biological systems. She is now working with Prof. Daniel Sussman on the soft matter properties of cell aggregates such as tissues and tumors during their fusion.

Dr. Yue got her Ph.D. from the University of California San Diego, where she studied the chemotactic signaling network of cells spanning from single-cell level to multicellular level and the collective migration of thousands of cells in the epithelial sheet in Dr. Wouter-Jan Rappel's group. Then she joined Prof. Alex Mogilner's group as a postdoc at New York University to study the effect of intra- and intercellular mechanical forces on the collective movement of cell

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