Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500 046

Internal Webinar

Stabilising Nonequilibrium Monodisperse Droplets via Thermophoresis

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Ostwald ripening typically governs the coarsening dynamics of liquid droplets, whereby larger droplets grow at the expense of smaller droplets to minimise the interfacial free energy of the system. This process renders systems of monodisperse droplets unstable to spontaneous fluctuations. Here we describe a mechanism that arrests Ostwald ripening in a non-equilibrium steady-state by exploiting thermophoretic transport. Using the framework of linear irreversible thermodynamics (LIT), we predict a parameter regime in which an array of monodisperse droplets is stable with respect to coarsening, nucleation, and cavitation. We also derive and implement a stochastic lattice model that corroborates our LIT predictions and provides further evidence for the stabilisation of monodisperse droplets under these conditions. Our work suggests a practical route to achieving size control in synthetic phase-separating mixtures.

Monday, May 26th 2025

11:30 Hrs