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Predicting and measuring the effects of colloid polydispersity during spinodal decomposition JOHN WILLIAMSON, Georgetown University, R. MIKE L. EVANS, University of Leeds — Polydispersity pervades soft matter physics, but remains so poorly understood that its effects are often guessed at or ignored entirely. Significant progress has been made on the phase equilibria of polydisperse colloids, but practical understanding of the kinetics that govern real systems lags behind. We employ Kinetic Monte Carlo simulation to study the gas-liquid spinodal decomposition of a size-polydisperse colloid, particularly focusing on fractionation (demixing) between the phases, an effect which causes the properties of the "daughter" phases to depart significantly from the overall "parent" particle distribution. We find that intricate fractionation takes place from the earliest times, so can play a role even in arrested, far-from-equilibrium states (e.g. gels). Novel techniques (in principle applicable to experiment) are developed to detect fractionation: a parameter-free method of systematically coarse-graining local volume fraction; and several spatial correlation functions. The qualitative features of fractionation, including a striking dependence on inter-particle potential, are correctly predicted by a theory requiring only a monodisperse reference free energy.

References: JJW and RMLE J. Chem. Phys. 141 (2014), Phys. Rev. E. 86 (2012).

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