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FRACTAL SIGNATURES IN MULTI-SCALE DOMAIN MORPHOLOGIES

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Abstract:

Many experiments yield multi-scale morphologies which are smooth on some length scales and fractal on others. Accurate statements about morphological properties, e.g., roughness exponent, fractal dimension, domain size, interfacial width, etc. are best obtained by the correlation function and structure factor. The signature of fractal domains and interfaces is a power-law decay with non-integer exponents in the correlation function C (r) and the structure factor S (k). The power yields the fractal dimension of the underlying geometry, and the law holds over length scales which can probe this geometry. The behaviors of C (r) vs. r and S (k) vs. k in multi-scale morphologies therefore, are characterized by cross-overs from one form to another. In this talk, we reanalyze scattering data of three diverse examples: (a) droplet-in-droplet morphologies of double-phase separating mixtures; (b) network-forming viscoelastic phase separating mixtures; and (c) ground state morphologies in dilute anti-ferromagnets. We discover unexpected fractal morphologies in these systems which yield novel insights on the phenomena at the micro-scale.