

What Do Images Mean?

Last fall, I had the pleasure of attending a workshop on Images of the Nanoscale, hosted by the National Science Foundation and the University of South Carolina NanoCenter.¹ It brought together scientists, engineers, artists, philosophers, and others to discuss the meaning of nanoscale images and to draw out strategies to endow them with greater meaning and insight.

The development of imaging tools such as scanning probe and electron microscopies has made nanoscience and nanotechnology research highly visual, in a way that is coming to match the stunning imagery of astronomy and the life sciences. We have all been dazzled by renderings of atoms on surfaces, with pleasing periodicity or mountain-peak-like protrusions on otherwise gentle landscapes. There is a natural beauty of matter at this scale that we have only recently come to find. Now we must ask: as such images are rendered, how might we instill greater meaning, so that the viewer is led to understand this world and what has been measured or simulated?

One of the most intriguing issues raised at the workshop was how to convey key properties and features of the nanoscale. What are the equivalents of gravity, reflectivity, and all the other interactions and properties that shape the macroscopic world around us as we know it (Figure 1)? How can we illustrate the dominant phenomena that rule the nanoscale world? It is a world that we ourselves are just now exploring and trying to understand. The relationship between nanoscience and art thus far has been based to a great extent on such devices as false-colored images and atomistic simulations. There is so much more that we will be able to do if we can develop our intuition to give ourselves and others the “feel” of important aspects of this world.

Some early examples of striking images that illustrate specific nanoscale properties, such as wetting on functionalized surfaces, varying optical properties of different size nanoparticles, and phase separation in polymers (Figure 2), come from the collaborations between Felice Frankel and the laboratories of George Whitesides and others.^{2–4} They make reference to what we know and understand from the macroscopic world around us. I hope that we will next develop the means to expand such illustrations to convey the competition between different forces and the great control we are now developing over *nanoscale* structures, properties, and functions.

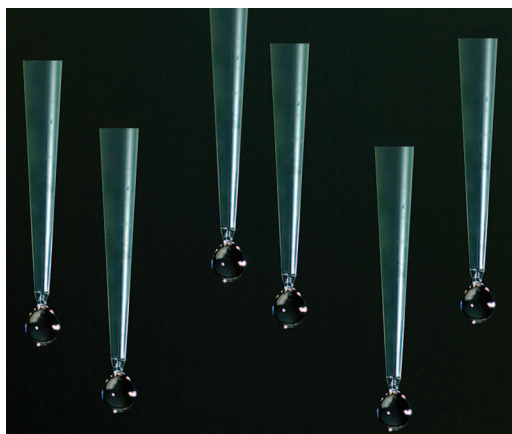


Figure 1. A drop of water at the tip of a syringe balances gravity and interfacial forces. The surfaces reflect light in familiar ways.^{2,3} Image courtesy of Felice Frankel.

How can we illustrate the dominant phenomena that rule the nanoscale world?

Another discussion at the workshop revolved around what happens when images and their scientific explanations become dissociated. Do images take on meanings of their own? Are new meanings attributed to them as they are disseminated? Based on the interpretations offered of some of the iconic images of the nanoscale world, the answer to both of these questions is yes. On our Web site ACS Nanotation,⁵ we will provide some lasting annotation to nanoscale images and research. We will look both retrospectively and in real time at the images that shape our views of the nanoscale world.

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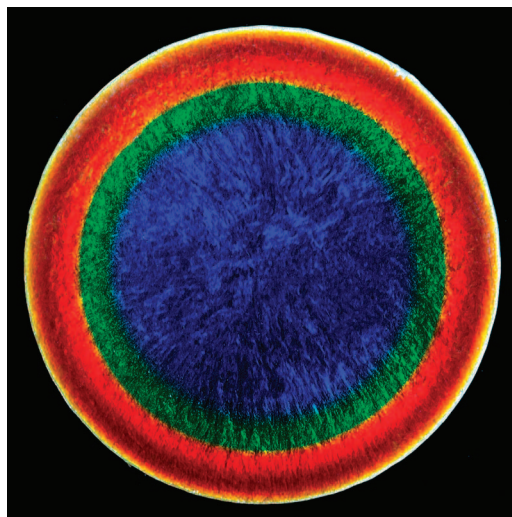


Figure 2. Interfacial forces govern phase separation in polymers and other systems at the nanoscale. Here, polymers reflect light in a rainbow-like fashion governed by their phase separation from core to exterior; total diameter is 2 cm.⁴ Image courtesy of Felice Frankel; polymer prepared by Jongseung Yoon and Prof. Edwin L. Thomas at MIT.

On these pages, we will develop, discuss, and advance these ideas further. I expect that we will see the products and results of these discussions in the images presented within *ACS Nano*, in our outreach to the public, and in our own developing sense of what constitutes the nanoscale world.

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