What Makes the Nanoscale So Special?

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In the last 20 years, the word “nano” has become fashionable in science and engineering. It is almost true that to obtain research funding or publish a paper, the word “nano” has to appear somewhere. But is there more to nanoscience than getting funding or publishing papers? As I will show in this talk, the nanoscale is indeed a very special scale. There are a number of fundamental phenomena that are only observable at the nanoscale, such as the breakdown of the continuum picture, the onset of quantum effects, the convergence of energy scales, and the emergence of long time scales and spontaneous structure from the chaotic motions of atoms and molecules. These phenomena, if properly understood, enable us not only to design and build completely new devices, but also help us to understand many fundamental problems in Nature. This includes Life, which is ultimately based on molecular machines using the nanoscale convergence of energy scales to produce the astonishing activity in our cells. I will illustrate some of these phenomena by research from our nanomechanics lab in the Wayne State physics department, including atomic scale dissipation, quantized conductance, dynamics in nanoconfined liquids and single molecule mechanics.

All students, faculty, and public are welcome.