Bending Nanotubes with Microbubbles
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Abstract from the paper:
Manipulation and microrheology of carbon nanotubes with laser-induced cavitation bubbles

Carbon nanotubes and nanorods are among the stiffest materials on Earth with diameters ranging from of a few to hundreds of nanometers and lengths on the order of tens of micrometers. These nanomaterials are prospective candidates for future composite materials with unprecedented elastic properties. However, measuring the stiffness of an individual nanorod or nanotube remained a challenge because it's hard to manipulate individual objects of such small size while exerting sufficiently high forces. A novel method based on bubbles has been developed by the Fluid Mechanics group at the Division of Physics from the Nanyang Technological University in Singapore. They generate a couple of microscopic bubbles very close to the submerged nanotubes using a laser pulse. The flow created by the microbubbles is so fast and localized that it induces a large deflection of the nanotube for a brief moment. A high-speed camera records the shape of the nanotube during this impulsive flow lasting for a few microseconds. The nanotube’s elasticity can then be measured by analyzing the bending deformation and the speed of shape recovery. The authors of the upcoming Physical Review Letter’s article foresee a promising future of this bubble technique to probe the elastic properties of many kinds of nanomaterials due to its ease of implementation.