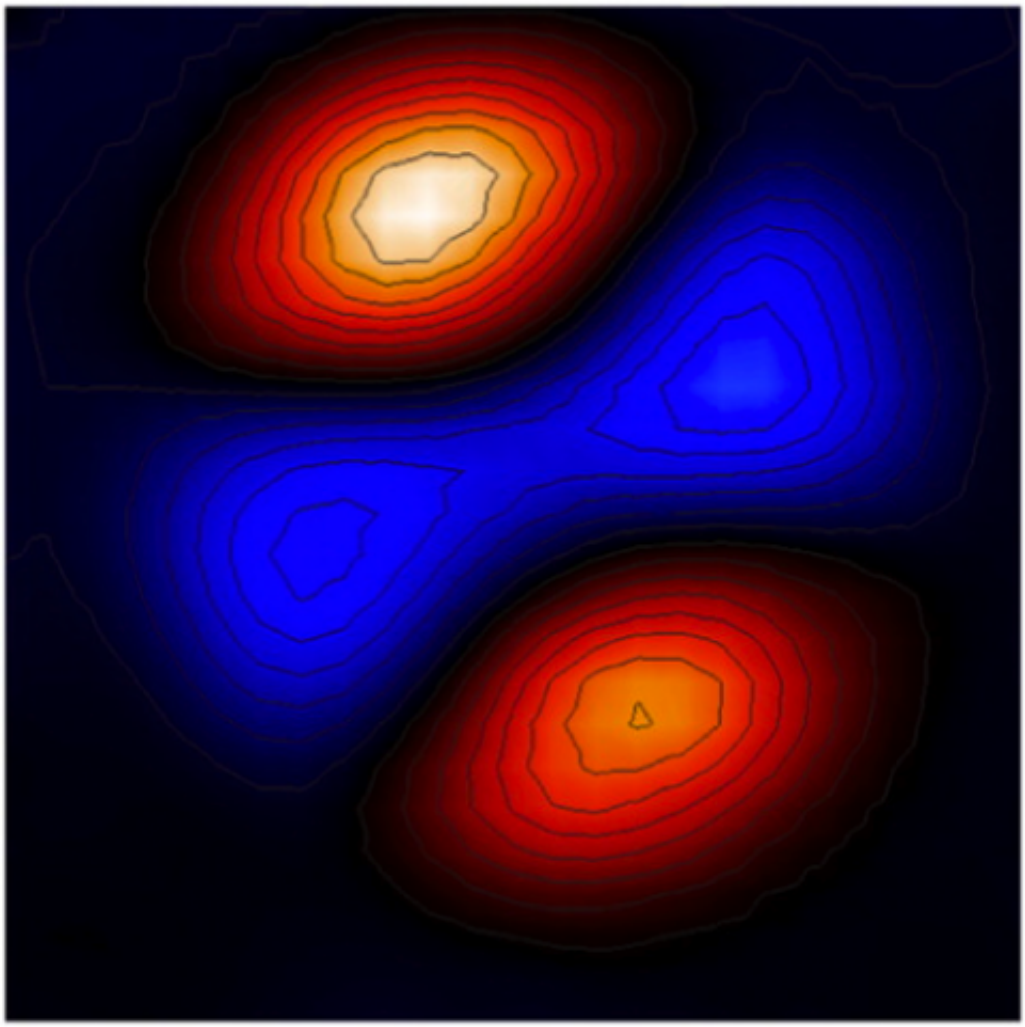
Nanomechanical resonator self-assembled from nanoparticles

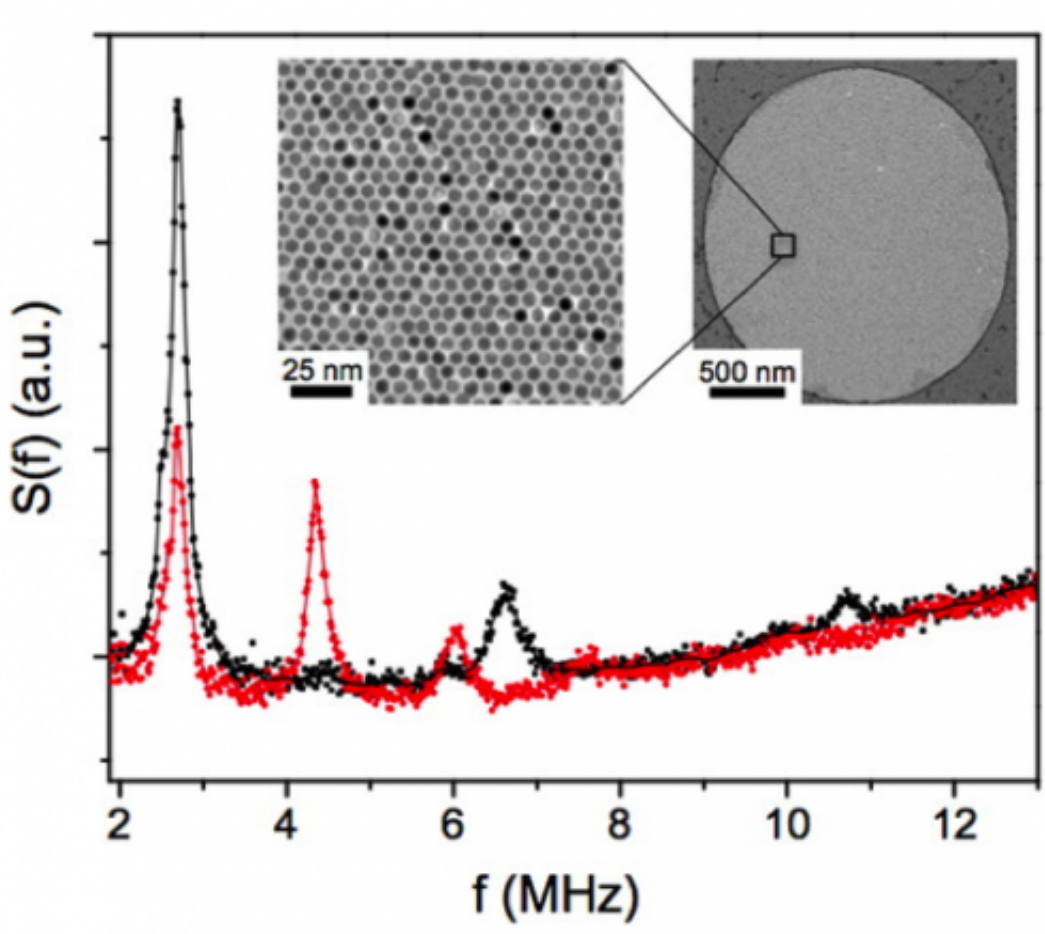
June 12 2013



Phase-sensitive image of one mode of membrane motion under mechanical excitation.

The self-assembly of nanoscale structures from functional nanoparticles has provided a powerful path to developing devices with emergent properties from the bottom up. Users from the University of Chicago, together with researchers from the University of Melbourne and CNM's Electronic & Magnetic Materials & Devices Group, demonstrate that free-standing sheets self-assembled from various nanoparticles form versatile nanomechanical resonators in the MHz frequency range.

Using spatially resolved laser interferometry to measure thermal vibrational spectra and image vibration modes, the research team shows that the resonator's dynamic behavior is in excellent agreement with linear elastic response for prestressed drumheads of negligible bending stiffness.



Power spectral distribution of the thermal motion of membranes self-assembled from gold nanoparticles taken at the center (black) and halfway along the radius (red) in air; inset shows TEM images of the membranes.

Fabricated in a simple one-step drying-mediated process, these resonators are highly robust, and their inorganic-organic hybrid nature offers extremely low mass, low stiffness, and the potential to couple the intrinsic functionality of the nanoparticle building blocks to nanomechanical motion.

More information: Kanjanaboos, P. et al., Self-Assembled Nanoparticle Drumhead Resonators, *Nano Lett.* 13, 2158 (2013).

Provided by Argonne National Laboratory