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Nanoscale resonators in liquid

All-optical drive and detection system for nanomechanical resonators

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Mechanical resonators are used in a number of sensing applications, but when smaller operating devices are required in the type of viscous environment most relevant to biological systems, losses resulting from viscous drag arise. Indeed, this problem of viscous damping has prevented nanoscale flexural resonators from operating in a liquid environment. Harold Craighead and colleagues demonstrate the operation of radio-frequency nanoscale resonators in air as well as liquids such as water, alcohol and buffer[1]. Bilayered beam-type devices (with cross-sectional dimension of the order of 100 nm) made of gold/chromium on silicon nitride are driven into resonance by modulating the amplitude of a focused blue laser, leading to a differential expansion of the materials and a harmonic flexural displacement. This laser drive technique can impart sufficient energy to overcome the strong viscous damping present in these media, resulting in a mechanical resonance that can be measured by optical interference techniques. This approach greatly extends the viscosity range over which such sensitive devices can be operated, and provides insight into our understanding of the interaction of such small mechanical devices with their environments.

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1. Scott S. *et al.* Optically driven resonance of nanoscale flexural oscillators in liquid. *Nano Lett.* Published online 18 August 2006)
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