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Bubble phononic crystals

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Our aim is to investigate phononic crystals consisting of periodic arrangements of micron size gas bubbles. Such crystals are of great potential interest. Because of the high compressibility and high acoustic impedance contrasts between gas and water, a gas filled bubble in water is indeed a strong acoustic scatterer with a large value of its resonant wavelength compared with its size and a scattering cross-section several orders of magnitude larger than its geometrical cross-section. In that sense a microbubble can be viewed as the equivalent of an acoustic atom and even a small size sample made with such bubbles is expected to have a dramatic impact on acoustic propagation. Using microfluidics techniques we were able to produce perfectly monodisperse gas bubbles in a liquid. When these bubbles (radius=50μm) are then injected into a liquid with surfactant, they are found to organize themselves to form an hexagonal close packed crystal. Its stability has still to be optimised before testing it successfully with acoustic waves. The calculation of the band structure of that crystal with the plane wave expansion (PWE) method confirms its interest for controlling propagation of MHz-ultrasounds: a 800-kHz wide band gap around 1.85 MHz is predicted.