**Magic with acoustic metamaterials**

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Acoustic metamaterials are non-naturally occurring structures consisting of arrays of sub-wavelength resonators designed to manipulate the propagation of sound, exhibiting effective negative density or modulus [1,2]. Counterintuitive metamaterial properties such as acoustic negative refraction, superlensing and cloaking have been demonstrated.

Another example is extraordinary acoustic transmission, i.e. the passage of more acoustic energy than expected through a small sub-acoustic-wavelength aperture acting as an acoustic meta-atom. This has been be demonstrated in a variety of systems, having first been shown in optics. I will first present our experimental work in this field using kHz airborne acoustics [3], in which case we find giant transmission, with enhancements up to ~60, by use of an aperture closed with a membrane. I will then show how gigantic transmission enhancement, by more than a factor of 500, can be achieved in solid acoustics [4,5].

Closely related to extraordinary acoustic transmission is the phenomenon of enhanced transmission between acoustically mismatched media. I will review experimental work on the enormously enhanced passage of acoustic waves from water to air based on the use of a kHz acoustic metasurface [6].

Finally, I will present recent kHz experiments on acoustic metabeams [7] and metarods [8] with perfect bandgaps that prevent all vibrations from passing along them at certain frequencies. The era of metawands that do not vibrate is upon us.

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