as is further demonstrated by Sun *et al.* by using the SLM to mimic the reversal of the arrow of time.

In the past, the observation of the optical kinetic condensation has been hampered by two main problems: the difficulty in achieving large propagation distances and the need for a precise control of the beam randomness. The work by Sun and colleagues[1] solves both, and represents an impressive demonstration of the ability to deliberately control the statistical processes involved in nonlinear light propagation, at will. It thereby represents a promising, potentially powerful technique in other contexts, such as laser propagation through random media[6], where SLMs can engineer transmission in turbid matter, or self-assembled disordered lasers[7], where they can control emission from nanostructured optical cavities.

More broadly, studying the effects of the statistical properties of a large number of particles is a frontier in the science of complex systems, which includes swarming of insects, the behaviour of networks, and the properties of granular and other disordered systems. If one is able to exert precise control over the behaviour of individual agents at the microscopic level, be they insects or photons, one can explore how the collective dynamics of a system at the macroscopic level can be controlled. Extending these ideas to the realm of photonics is still at an embryonic stage. But these ideas could soon be translated to realize previously unimaginable tasks, such as controlling the propagation of light through random media or shaping beams to cancel out diffraction in materials that can be tailored at will[8]. One could also start thinking about using photonic condensation for new forms of light conversion, such as from incoherent sunlight to coherent laser light. Or even perhaps pursue the idea of 'supercondensation' — classical condensation in quantum-condensed Bose–Einstein condensates — which presents new opportunities to explore connections between turbulence and atomic physics. ❒

Claudio Conti is at the Department of Physics, University Sapienza, Piazzale Aldo Moro 5, Rome, 00185, Italy.
e-mail: claudio.conti@uniroma1.it

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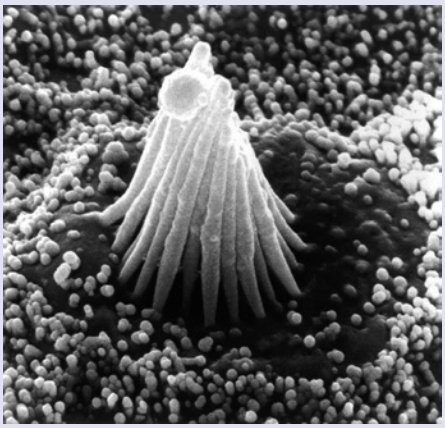
BIOPHYSICS

Two-tone deaf

Are your ears playing tricks on you? Jérémie Barral and Pascal Martin think they are — and they have good reason to blame spontaneous oscillations that occur at a cellular level deep inside your hearing machinery (*Proc. Natl Acad. Sci. USA* http://doi.org/hwt; 2012).

When two tones of similar frequency stimulate the auditory system, perception of one tone is compromised by the presence of the other. The combination of the two frequencies can also make us think we're hearing additional tones that correspond to linear combinations of the actual input frequencies.

These effects are thought to originate in the sensory hair cells of the inner ear. Hair cells — named for the tiny bundles of stereocilia (pictured) protruding from their surface — are responsible for mechano-electrical transduction of sounds. Incoming vibrations deflect the stereocilia, opening mechanically gated ion channels at the tips of the bundles. The influx of ions triggers a receptor potential that in turn opens voltage-gated channels, allowing ions to flow into the cell and activate neurotransmitters that send the signal to the brain.



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The relationship between hair-bundle deflections and the resulting transduction currents is inherently nonlinear, which has led people to infer that this nonlinearity is responsible for distorting the receptor potentials and inducing two-tone interference in hearing. But transduction nonlinearity is insufficient to explain all the details of the phenomena. And now, Barral and Martin have shown that many of these details can be recovered by considering the nonlinearity associated with active movements of the hair-cell bundles.

Far from being exclusively enslaved to stimuli, hair-cell bundles also undergo spontaneous active oscillations, which have been shown to boost hearing sensitivity and aid frequency-tuning ability. The hair cell actively controls these deflections, which result in frequency-selective amplification of incoming sounds. The study reports measurements of active oscillations in the hair cells of the bullfrog, revealing a key role for active oscillations in sponsoring the type of nonlinearity that causes phantom tones and suppressive masking.

By interpreting their data within the framework of an active dynamical system in the vicinity of a Hopf bifurcation, Barral and Martin have identified the mechanism behind two-tone interference with the behaviour of self-sustained critical oscillators. It seems as though the very same active oscillations that fine-tune our hearing apparatus are also instrumental in fostering erroneous auditory effects.

ABIGAIL KLOPPER