annular channels in which self-propelled particles establish a chiral flow even in the absence of any external drive. Starting from a symmetric Lieb lattice (Fig. 1c), self-propulsion spontaneously breaks the parity symmetry, and left-handed or right-handed flows are selected in each lattice site, with neighbouring annuli necessarily rotating in opposite directions because of the alignment of particle velocity at common edges. The result is a violation of microscopic reversibility, which, combined with parity-symmetry breaking and the specific choice of lattice geometry, induces strong topological order. In the acoustic bandgap, well-confined topologically protected one-way edge modes emerge, and domain walls can be sculpted to introduce defects in the bulk.

Two major advantages are offered by this geometry. First, the topological order is self-supported by the spontaneous flow in the medium, and therefore it does not need to be imparted by an external bias. In addition, in these active materials the propulsion velocity and the speed of sound can be independently controlled. This makes it possible to tailor the two velocities to be comparable, opening wide-frequency bandgaps with non-trivial topological order and highly confined edge modes.

Although the idea is exciting, and shows how the field of active media, combined with metamaterial concepts, can offer many new opportunities for wave control, the presented work is limited to a theoretical analysis and numerical simulations in the continuum limit. In the next steps, it will be interesting to see the translation of these efforts to realistic experimental setups in which spontaneous self-propulsion will enable the emergence of a new topological order of matter. More broadly, this work shows the relevance of the field of active metamaterials, in which microscopic irreversibility, inherent symmetry breaking and an external energy reservoir create unprecedented capacity to manipulate wave propagation for acoustics, electromagnetics and mechanics. ❐

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SOFT MATTER

Sticky fingers

When you grip something — a pen, a tool or even the handlebars of your bike — it immediately feels more secure if the handle is made of something rubbery. But why are our hands not as good at gripping stiffer materials? As Brygida Dzidek and co-workers have now shown, the answer lies in the composition of our finger pads (*Proc. Natl Acad. Sci. USA* **114,** 10864–10869; 2017).

Dzidek *et al.* pressed a prism onto the fingertips of a number of individuals, and then tracked the evolution of their fingerprints on the surface. Across variable experimental conditions, what emerged was that the contact area between fingers and surface is initially extremely small, but then grows over time. For rubbery surfaces, the maximum contact surface was reached extremely quickly, whereas for stiff materials like glass, saturation of the contact surface took as long as 20–30 seconds.

Looking at the fingerprints left on glass, at first they resemble a scattered collection of marks left by the ridges that we have on our finger pads — often by the bigger ones that are found right in the middle of the fingertip (pictured). The marks left later are influenced by the plasticity of our superficial skin layer, the stratum corneum, which is largely composed of keratin — a stiff material in dry conditions. As our fingertips sweat, moisture softens the keratin, which in turn leads to an increase of the contact area between fingertip and surface. This happens gradually over the time it takes for sweat to diffuse in the skin layer. Conversely, when we touch a surface that is softer than keratin, there is no need to wait for the emollient effect of sweat — hence the immediate firm grip we have on rubber.


RTIMAGES/ALAMY STOCK PHOTO

As a next step, the researchers studied the evolution of the surface friction over time. Despite the fact that plasticized keratin loses interfacial shear strength, leading to a potential decrease in friction, the substantial increase of the surface contact area more than compensated for this loss. As a result, the friction between our fingers and a glassy surface was found to double as our skin gets sweaty. The fact that this might come as a surprise is a testament to the ability of our body to adapt our behaviour in light of vastly changing microscopic conditions.

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