temperature. They showed that the plasmon wavevector is indeed tunable by changing the width and periodicity of the grating. Then, by comparing their measurements with theory, they isolated the effect of phonon scattering in the system and demonstrated that the plasmons thus exhibit a dispersion that is consistent with a collective excitation of the two-dimensional Dirac surface-state electrons, rather than with the massive bulk electrons.

Moreover, it has been shown that the spin texture of the Dirac surface states in topological insulators prevents the backscattering of electrons from non-magnetic defects. Such inherent robustness would make the surface-state electrons more immune to surface quality issues and could result in an enhanced lifetime of the plasmons. Lupi and co-workers show some evidence of this effect, as they found that the plasmon linewidth, a parameter that is usually sensitive to the lifetime of the species under study, changed surprisingly little with temperatures ranging from 6 to 300 K. The insensitivity of these plasmons' lifetime with temperature is quite unlike that observed for plasmons in normal two-dimensional electron gases and the implications of this observation for electron–phonon coupling in topological insulators are still to be understood.

Graphene has already proved itself as an interesting plasmonic material and several applications, such as low-cost terahertz detectors, are being developed[7]; it is now the turn of topological insulators to follow suit. The observation of surface plasmons in topological insulators is only the first step. The next steps would be to prove the existence of spin plasmons, study their properties to see what they can be useful for, and develop a new generation of plasmonic devices. Here, theory is ahead of experiments, as spin-rectifiers[8] that use plasmonic spin waves to drive spin currents in spintronic devices have already been envisaged. After the discovery by Lupi and co-workers, it is time for the experiments to catch up. ❐

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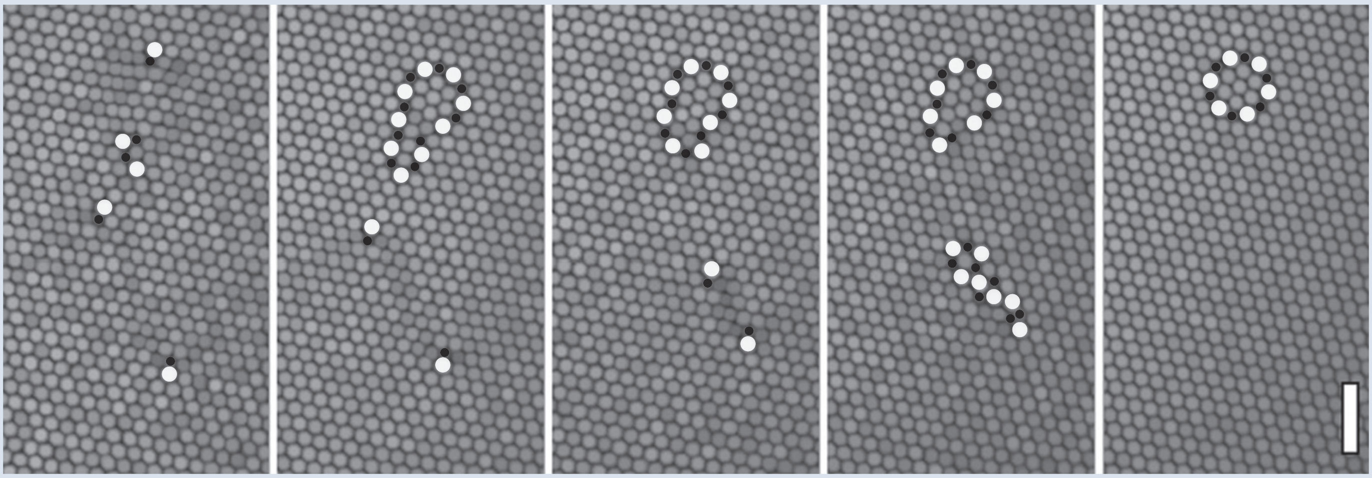
ELECTRON MICROSCOPY

Watching the rise and fall of a dislocation



Visualizing the diffusion of dislocations in a crystal can provide important insights into the mechanical properties of the material. Ossi Lehtinen and colleagues at the University of Ulm, the University of Helsinki and Aalto University have now followed the full life cycle of dislocations in graphene, from creation to annihilation, with atomic resolution (*Nature Commun.* **4,** 2098; 2013).

The dislocations were generated by the beam of an aberration-corrected transmission electron microscope, which was then used to follow the diffusion of the dislocations through the graphene lattice. The essential driving force for this process is the interaction between two dislocations, and successive microscopy images showed that isolated dislocations attract each other until they eventually undergo annihilation.

The series of five filtered microscopy images (pictured; scale bar, 1 nm) shows the attraction and annihilation of four distinct dislocations. White and black circles highlight pentagons and heptagons in the graphene lattice, respectively. At the bottom of the images, two dislocations can be seen to migrate towards each other, forming a more intricate structure. They then annihilate each other, leaving behind a perfect hexagonal lattice. At the top, a more complex rearrangement is observed in which the dislocations evolve into a circular grain boundary that separates domains of pure graphene.

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