of the splitting of energy levels in metallic dots[5] localized in a nanowire matrix. The ferromagnetic behaviour of nickel silicide and cobalt silicide also suggests potential application of these structures in the area of topological superconductivity, where these arrays could be used as artificial spin–orbit inducers in otherwise spin–orbit-neutral materials such as silicon[6]. The crystal-growth method presented by Ross and colleagues is a promising pathway to improving performance and functionality of a broad range of devices, making use of nanoscale materials with high-quality interfaces and well-defined physical properties. ❐

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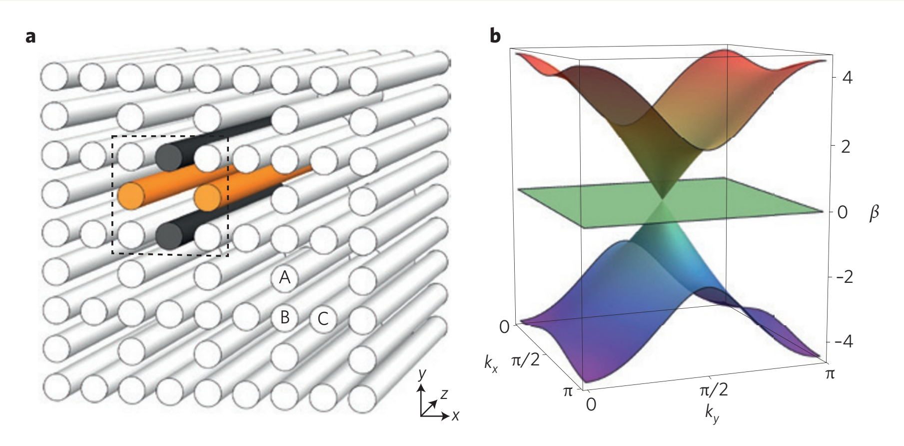
PHOTONICS

Trapped in a flat dispersion

The prevention of the diffusion of light and the engineering of localized states has attracted a lot of attention, following Phillip Anderson's proposal in 1958 that scattering due to disorder can stop transport. Intense research on the topic shed light on the fundamental processes involved, and revealed novel applications such as random lasing. Anderson localization describes the confinement of waves in disordered media beyond a critical value for scattering, on the basis of an interference effect between counter-propagating waves. However, disorder is not a prerequisite for localization, as destructive wave interference can also be engineered in specific geometries. This would be translated in a flat, dispersionless energy band with degenerate states, whose superposition displays no dynamical evolution. Now, writing in *Physical Review Letters*, two independent teams led by Robert Thomson (**114,** 245504; 2015) and Mario Molina (**114,** 245503; 2015) report the first experimental observation of diffraction-free propagation of such a flat-band state in a Lieb photonic lattice.

The unit cell of the so-called Lieb structures consists of a collection of three sites (A, B and C) arranged in an L-shape within a square region (Fig. 1a), with the site in the fourth corner remaining empty. Coupling is allowed only between A and B, and B and C, with the coupling coefficients being uneven. In the anisotropic case, the dispersion relation consists of three bands: a flat one intersecting with two other linearly dispersing bands (Fig. 1b). Both teams explored theoretically and experimentally the possibility of obtaining diffraction-free propagation of the flat-band states.



PHYS. REV. LETT. 114, 245503 (2015); APS

The teams used a femtosecond laser-writing technique to fabricate arrays of low-propagation-loss, single-mode waveguides for operation at a specific wavelength that matches the Lieb photonic-lattice arrangement. The teams recorded the output patterns when light at the resonant wavelength was injected into a single waveguide at the input facet of the array.

The two teams observed (as previously reported in *New J. Phys.* **16,** 063061; 2014) that the light injected in site B diffracts more as it propagates than the light injected in sites A and C. This is because in the last two cases the projection on the flat band dominates. The authors probe the flat dispersion states by exciting simultaneously only two A-sites and two C-sites forming a square (coloured arrangement in Fig. 1a). Under these conditions, they observed near-perfect propagation, with minimal diffusion in the surrounding waveguides, confirming that the states indeed remain localized. They also concluded that localization is sensitive to the intensity and phase distribution of the particular state, as the output patterns change with different conditions and the coupling between the surrounding waveguides becomes significant.

The high control of the localized states demonstrated in these reports provides a new direction for trapping waves in structures with similar flat-band characteristics, for applications relevant to sensing, optical fibres and telecommunications.

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