Research Highlights

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Nanowires: On the dot

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Quantum dots confine electric charges in three-dimensional cages and are widely used owing to their unique electrical and optical properties. Although confinement is typically achieved by using small particles, other techniques such as electrostatic gating have been used to create dots in one-dimensional structures such as nanotubes. Now, Val Zwiller and colleagues at Delft University and the Laboratory for Photonics and Nanostructures, CNRS, have made a quantum dot in a nanowire by controlling the nanowire's crystal phase.

The wurtzite- and zinc-blend crystal phases of an indium phosphide nanowire serve as barriers to electrons and holes, respectively. By growing alternating layers of these phases, Zwiller and colleagues confined charges along the direction of the nanowire. The small diameter of the nanowire also confined charges in the remaining two dimensions. The successful confinement of charges by the quantum dots was then demonstrated in four different ways. The colour, decay speed and timing of photons emitted by the nanowire under illumination reflected the energies of the trapped charges and their degree of separation. Transmission electron microscope images of the nanowire structure also showed the variations in its crystal structure.

The results demonstrate that nanowire crystal phases can be modulated to create structures with useful electronic properties. Nanowire quantum dots could find application in spin-based memories and solar cells, both of which require opposite charges to be separated.

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