their work with strontium-doped lanthanum nickelate (LSNO) in the October 24 issue of *Nature Communications* (DOI: 10.1038/ncomms3643).

Lead author Giacomo Coslovich, a postdoctoral researcher at Berkeley Lab, said, "We chose to work with LSNO because it has essential similarities to the cuprates (an important class of high-temperature superconductors), but its lack of superconductivity lets us focus on understanding the stripe phase alone."

In this LSNO crystal, stripes form only at cryogenic temperatures of about –168°C, yet at far higher temperatures, the team hit upon large changes in the material's infrared reflectivity. These invisible "color" changes represent an energy threshold for electrical currents, dubbed the energetic "pseudogap," which grows as the crystal cools, revealing progressive localization of charges around the nickel atoms.

The scientists then examined the dynamics of LSNO in pump-probe experiments, where they melted stripes with an initial ultrafast pulse of laser light and measured the optical changes with a second, delayed pulse. This allowed them to map out the early steps of charge ordering, exposing surprisingly fast localization dynamics preceding the development of organized stripe patterns. A final twist came when they probed the vibrations between nickel and oxygen atoms, uncovering a strong coupling to the localized electrons with synchronous dynamics.

Beyond the ultrafast measurements, the team also studied x-ray scattering and the infrared reflectance of the material to develop a thorough, cohesive understanding of the stripe phase and why it forms.

Having illuminated the origins of the stripe phase in LSNO, the researchers expect their results to provide new impetus to understand the pseudogap in other correlated oxides—especially in high-temperature superconductors where fluctuating stripes occur while their role in the superconductivity mechanism remains unclear.

Alison Hatt

Bio Focus

Bacteria construct tiny flagella "nanomachines" outside the cell

Researchers at the University of Cambridge have uncovered the mechanism by which bacteria build their surface propellers (flagella). The results, published in the November 10, 2013 online edition of *Nature* (DOI:10.1038/nature12682), demonstrate how the mechanism is powered by the subunits of the flagella themselves as they link in a chain that is pulled to the flagellum tip.

Previously, scientists thought that the building blocks for flagella were either pushed or diffused from the flagellum base through a central channel in the structure to assemble at the flagellum tip, which is located far outside the cell. However, these theories are incompatible with recent research that shows that flagella grow at a constant rate. The unexpected chain mechanism, in which subunits linked in a chain pull themselves through the flagellum, transforms current understanding of how flagellum assembly is energized.

The research team, led by Gillian Fraser and Colin Hughes, found that as each flagellum "nanomachine" is assembled, thousands of subunit building blocks are made in the cell and are then unfolded and exported across the cell membrane. Like other processes inside cells, this initial export phase consumes chemical energy. However, when subunits pass out of the cell into the narrow channel at the center of the growing flagellum, there is no conventional energy source and they must somehow find the energy to reach the tip.

The research team has shown that, at the base of the flagellum, subunits connect by head-to-tail linkage into a long chain. The chain is pulled through the entire length of the flagellum channel by the entropic force of the unfolded subunits themselves. This produces tension in the subunit chain, which increases as each subunit refolds and incorporates into the tip of the growing structure. This pulling force automatically adjusts with increasing flagellum length, providing a constant rate of subunit delivery to the assembly site at the tip.

Co-researcher Eugene Terentjev, of the Cavendish Laboratory, said, "Understanding how polymers move through channels is a fundamental physical problem. Gaining insight into this [research on bacteria] has potential applications in other disciplines, for instance in nanotechnology, specifically the building of new nanomaterials."

Nano Focus

Slowly cooled DNA transforms disordered nanoparticles into orderly crystal

"Single crystals are the backbone of many things we rely on—diamonds for beauty as well as industrial applications, sapphires for lasers, and silicon for electronics," said nanoscientist Chad A. Mirkin of Northwestern University. "The precise placement of atoms within a well-defined lattice defines these high-quality crystals." Now Mirkin's research group has built near-perfect single crystals out of nanoparticles and DNA, suggesting that DNA hybridization can drive the assembly of nanoparticles by a similar route to the traditional crystallization of atomic species.

His research group developed the "recipe" for using nanomaterials as atoms, DNA as bonds, and a little heat to form tiny crystals. This single-crystal recipe builds on superlattice techniques that Mirkin's laboratory has been developing for nearly two decades.

In this recent work, reported in the November 27 online edition of *Nature* (DOI:10.1038/nature12739), Mirkin, an

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