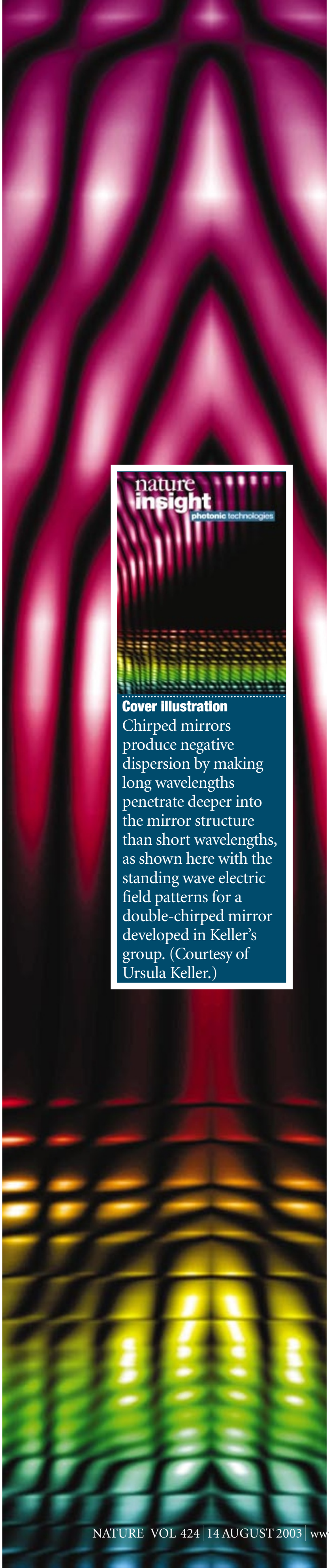

Cover illustration
Chirped mirrors produce negative dispersion by making long wavelengths penetrate deeper into the mirror structure than short wavelengths, as shown here with the standing wave electric field patterns for a double-chirped mirror developed in Keller's group. (Courtesy of Ursula Keller.)

nature insight

photonic technologies

Photonics—it's light, but not as we know it. Over the past couple of decades, new techniques have moulded the flow of light in useful and unusual ways. It could be argued that the field of 'photonics' was launched with the discovery of the laser in the 1960; with the advent of this pure, stable and bright light source, new opportunities arose for making use of light, of which perhaps the most notable is the adoption of light as a carrier of information. The now widespread implementation of fibre-optic telecommunication networks is a vivid demonstration of just how fast the technology has developed.

But photonic scientists are not content with using light as simply an information carrier; they are also exploring ways to exploit photons—the basic unit of light—to process and store that information. For instance, an optical circuit can, in principle, be constructed from a new type of optical material, called photonic crystals, in which photons can be manipulated in a manner similar to electrons in a semiconductor. Photons can travel much faster than electrons, which makes the prospect of processing information photonically tantalizing. Photonic chips that outperform their electronic counterparts are a long way from practical realization, but the idea in itself is a source of inspiration for scientists and engineers.

And yet there is more to photonics than imitating electronics. New applications are expected to result from studies where the flow of light is carefully controlled on small lengthscales or fast timescales. There is also a lot still to be learned about the interaction between light and matter. For example, how light is confined within small resonant cavities, how light is 'sculpted' to control the forces that it exerts on particles and how light is coupled to metallic structures smaller than its wavelength. Some of the research avenues that are currently being explored will lead to new optical technologies, and the purpose of this Insight is to highlight some of the most intriguing and promising directions.

Liesbeth Venema Senior Editor

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