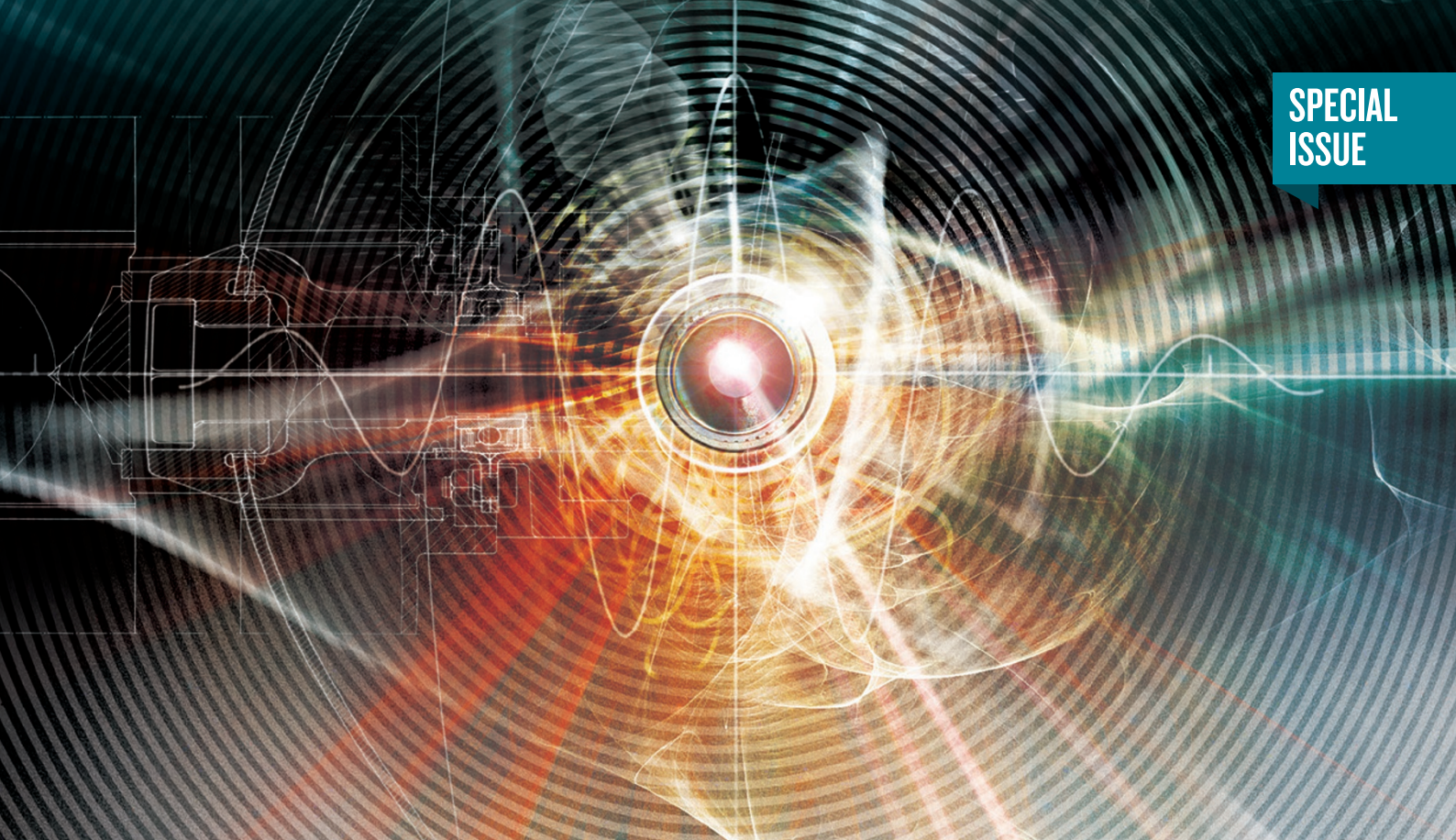


SPECIAL ISSUE

LIGHT FANTASTIC

Scientists are pushing the properties of light to new extremes. A special issue explores these frontiers.

From glorious rainbows to the intricate mechanics of the human eye, light lies at the heart of phenomena that have fascinated scientists for millennia. Today, the latest optical technologies — from lasers to solar cells — harness light to advance physics and to serve society's needs.

To put light itself in the spotlight, the United Nations designated 2015 the International Year of Light and Light-based Technologies. The celebration is also pegged to a string of anniversaries: Augustin-Jean Fresnel's proposal in 1815 that light is a wave; James Clerk Maxwell's 1865 electromagnetic theory; Albert Einstein's 1915 general theory of relativity; and in 1965, discovery of the cosmic microwave background (CMB) radiation and the development of optical fibres for communication.

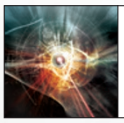
Nature is paying its own tribute to light in this special issue. Contorting light is the goal of three physicists profiled in a News Feature on page 154: Miles Padgett twists laser beams to encode binary information; Pierre Berini reshapes light waves to speed up digital communications; and Margaret Murnane dissects X-rays into ultrafast attosecond pulses, one billionth of a billionth of a second long, to probe materials in exquisite details.

Some advances in the physics of light are of great benefit to biology and medicine. Borrowing from astronomers, biophysicists are developing techniques for seeing through opaque layers, by detecting the minute glow of visible light scattered through body tissues. Such methods are likely to lead to more-powerful medical imaging, as explained on page 158.

In another sphere entirely, near-speed-of-light communications are set to transform financial trading as laser links between banking centres come online. But there are major risks, Mark Buchanan explains on page 161. Trading stocks in milliseconds pushes algorithms to their limits, exposing flaws that can escalate in seconds to cause hundred-million-dollar losses.

In a News & Views Forum on page 170, two cosmologists reflect on the clues to the origin of the Universe hidden in its oldest light, the CMB. And on page 164, physicist Jim Al-Khalili is dazzled by the afterglow of a 1,000-year-old treatise on the nature of light: Ibn al-Haytham's *Book of Optics*. An online collection will highlight key papers on light from journals across Nature Publishing Group throughout the year (see nature.com/yearoflight).

With so many facets, scientists' fascination with light looks unlikely to fade. ■



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