



IMAGINE EYES

COVER IMAGE

Adaptive-optics-enhanced imaging of the retina, clearly showing individual photoreceptors and blood vessels.

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Adaptive answers

Perhaps the most striking feature of photonic technology is the ease with which it can be applied to and benefit many different problems. A perfect example illustrating this point is adaptive optics — the topic of this month’s Technology Focus. Adaptive optics, which combines wavefront sensing with deformable mirrors to allow the correction of unwanted optical distortions, was initially developed by the military to send laser beams into space. It was quickly realized that this technology could provide astronomers with a better view of the night sky, and soon became a standard fitting on large ground-based telescopes to correct wavefront distortions induced by the atmosphere.

As the technology of adaptive optics matured and cost-effective, mass-produced deformable mirrors based on microelectromechanical systems became widely available (see page 21), the scheme soon found itself being exploited by commercial applications within industry. Today, adaptive optics has a myriad of other uses, with a list that is growing all the time. Popular examples are free-space optical data communications, laser materials processing, microscopy and

retinal imaging at a resolution that allows the health of individual photoreceptors to be assessed (see page 24). The National Ignition Facility, the next-generation laser fusion project in the USA, also uses adaptive optics to improve its focusing capabilities (see page 16).

That’s not to say that adaptive optics has lost its popularity in astronomy. On the contrary, planned upgrades at the Keck observatory in Hawaii and the Very Large Telescope in Chile include the implementation of new adaptive optics systems and improved artificial guide stars to function as fixed references (see page 16). NASA has also announced that it is exploring the use of adaptive optics for its space-based Terrestrial Planet Finder project.

Robert Tyson, book author and expert in adaptive optics from the University of North Carolina in the USA, perhaps best sums up the activity in this area in an interview on page 28. “Current interest in adaptive optics is at an unprecedented level,” he comments. “The number of research papers published has increased exponentially in recent years, and the possibilities in this field really are endless.” □

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