in both cosmology and particle physics since then has made inflation look less bold. It doesn't address two of the biggest questions today — the initial Big Bang singularity and the problem of the cosmological constant. Moreover, there is still no standard model; inflation only lessens the sensitivity to the initial state of the Universe, and the prospect of eternal inflation and the existence of a 'multiverse' are threatening to destroy inflation from within. Inflation is so powerful that many theorists are confident that if it took place once it must have taken place an infinite number of times, driven by quantum fluctuations in the inflaton. Although it might seem that one could ignore all but the occurrence that created our Universe, Guth and Steinhardt argue that the possibility of infinite copies of inflation undermines its predictability.

In a highly unscientific poll (taken during my summary talk) the audience was asked, is inflation essentially correct with some details to be filled in, or does it need to be replaced or at least expanded upon dramatically? In an audience of more than 100, only 56 chose to vote — 46 for the first proposition and 10 for the second. Perhaps most interesting was the large number who chose not to pick sides, indicating that although support for inflation is broad, commitment is not.

Twenty-five years on, it is clear that the 1982 VEU workshop was indeed a cosmological milestone, laying the theoretical foundation for cosmology today. Much has changed since then, most conspicuously the flood of laboratory and observational data bearing on cosmology and the size and the importance of the field. Today big questions are ripe for answering. Did the Universe inflate? What is the fundamental description of inflation? Or is there a more compelling model? Will the early Universe provide evidence for (or against) string theory? Can the initial singularity be resolved or eliminated? Powerful ideas, more data and a new generation of bright young cosmologists are rising to the challenge. As President of the Royal Society Martin Rees remarked at the conference banquet, this could well be the best time ever to be a cosmologist!

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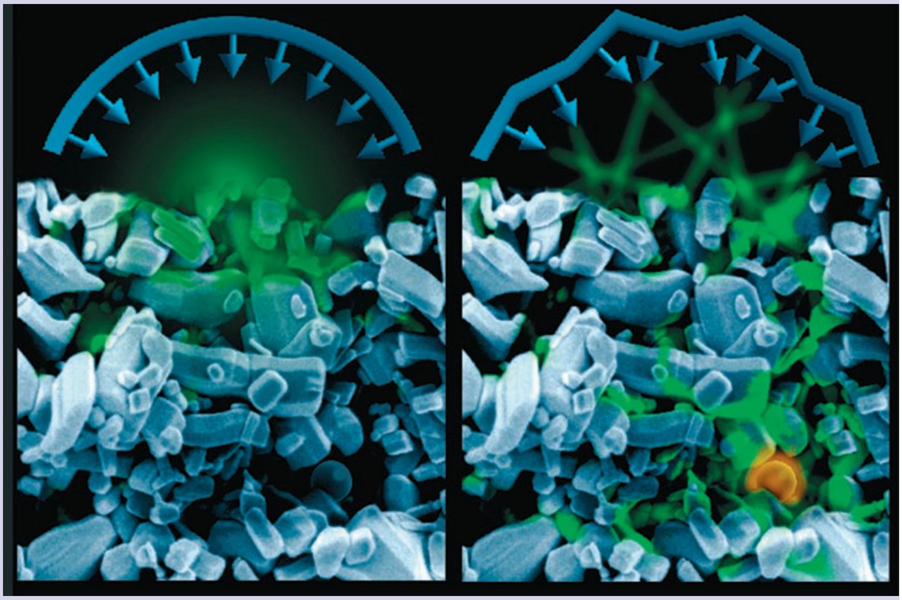
ADAPTIVE OPTICS

Scattered focus

Scattering makes it impossible to focus light within or through an optically diffuse medium by conventional means. The consequences of this are most notably evident on an overcast day. Diffuse scattering by clouds causes shadows to disappear — a bane for landscape photographers — and makes it difficult even to locate the Sun in the sky. Nonetheless, Ivo Vellekoop and colleagues show that for a disordered solid, fine control over the phase of an array of hundred of channels of incident light onto a sample makes it possible to compensate for this diffuse scattering, and to direct light within it (*Opt. Express* **16,** 67–80; 2008).

The key to the authors' approach is the fact that, unlike clouds, the microscopic structure of most disordered solids does not change with time. Consequently, although complex, the way in which light is scattered will be well-defined and deterministic. And so they figure it should be possible to make up for this scattering with an appropriately engineered optical field. To investigate the feasibility of this they embedded individual 300-nm-wide fluorescent spheres to various depths within an opaque 32-μm-thick layer of white zinc oxide pigment grains (with an average diameter of 200 nm). As expected, simply scanning focused laser light across the layer in an attempt to stimulate the fluorescent spheres results in a barely detectable fluorescent signal (left panel of figure). But passing the laser through a computer-controlled spatial light modulator composed of an array of 640 individual elements to finely adjust the distribution and phase of the incident light field, and using a feedback process to optimize this field, they find that they can indeed focus the light enough to stimulate an embedded sphere (right panel of figure). Moreover, they find that the success of this approach is independent of the depth of the sphere within a layer.



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The results demonstrate the feasibility of using multiple optical channels to characterize the complex propagation of light through a disordered material without prior knowledge of its structure. The authors suggest this could prove useful in biomedical imaging, by enabling light to be selectively focused onto fluorescent probes embedded within a sample of biological tissue.

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