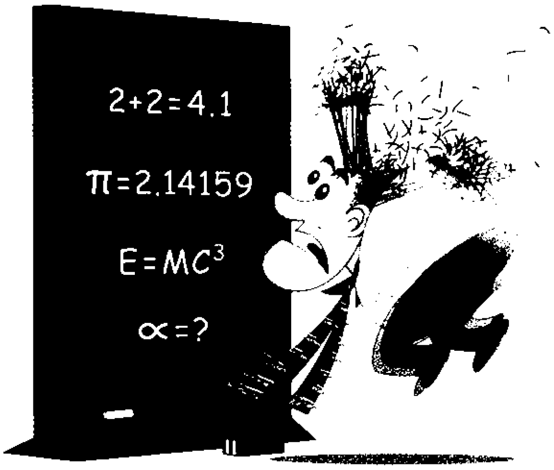


Alarming. The thought that the fine-structure constant is changing gives some physicists fits.

astrophysicist at the Institute for Advanced Study in Princeton, New Jersey.

The claim is based on observations of light from 72 distant quasars that has passed through light-absorbing clouds en route to Earth. Ions in those clouds, such as different valences of magnesium, iron, nickel, and zinc, each absorb certain narrow wavelengths of light, etching dark lines in the quasar's spectrum. Like a cosmic fingerprint, the pattern of the absorption bars tells scientists which ions reside in the clouds. And because an atom absorbs light due to the electromagnetic interaction between its nucleus and its electrons, the fine-structure constant affects where the bars appear. "The physics is pretty straightforward," says team member Jason Prochaska, an astronomer at the Observatories of the Carnegie Institution of Washington in Pasadena, California.

When Prochaska and other physicists from Australia, the United States, and England collected data from the distant quasars and analyzed the patterns of bars, they noticed that the spacing of the bars wasn't quite right. The pattern seemed to indicate that the fine-structure constant was about 0.001% smaller when the light was absorbed billions of years ago than it is now. In other words, the fine-structure constant has been increasing over time.

But other physicists are skeptical. "There's more ways to go wrong than to go right," says Bahcall. "This measurement is so sensitive to systematic uncertainties that I'm worried that one of them got them."

ILLUSTRATION: (TOP) TERRY SMITH

Lennox Cowie of the University of Hawaii, Manoa, has an alternative explanation for the strange spacing of the absorption lines. "Generally, it's likely to be things like different ions having slightly different velocities, as they reside at different points in space," he says. Because of the Doppler effect, the ions' different velocities shift the relative positions of the absorption lines. "In my own mind, that's the probable explanation," says Cowie.

But the team says it has already accounted for that effect. "I will be very surprised if this is the explanation," says team member John Webb, an astrophysicist at the University of New South Wales in Sydney, Australia.

Prochaska says he has unpublished data that strengthen the case for an inconstant constant, although he suspects they won't sway all critics. "Someone else needs to do it with a different telescope and a different instrument. That would be the proof of the pudding," he says. Until then, he agrees that cosmic change remains in doubt: "I wouldn't bet my life on it right today." —CHARLES SEIFE

SCIENTIFIC MISCONDUCT

Wellcome Rules Widen the Net

The U.K.'s biggest biomedical charity has filled a void by proposing its own guidelines and procedures for handling allegations of scientific misconduct. While generally winning high marks, the draft rules from the Wellcome Trust are likely to spark controversy by broadening the definition of misconduct beyond the U.S. government's standard and by offering relatively little protection to whistleblowers.

The draft guidelines, circulated late last month, would apply only to institutions receiving Wellcome funds. Even so, they could be a tonic for a scientific community that has been left to police itself without widely accepted definitions of both misconduct and good scientific practices. "Everyone in the U.K. seems to agree that something needs to be done, but no one seemed to be willing to take action," says Wellcome's Robert Terry.

"This is an extraordinarily positive development," says ethics expert C. Kristina Gunsalus, associate provost of the University of Illinois, Urbana-Champaign. "The most important thing is that someone in the U.K. has finally taken the initiative."

The Wellcome document gives a fuller—and perhaps more contentious—definition of misconduct than parallel regulations governing U.S. federal funding developed by the Office of Science and Technology Policy (OSTP) (see table). While approving Wellcome's overall approach, some experts quibble with the details. Although both the trust's and OSTP's definitions include plagiarism, fabrication, and falsification of data, the Wellcome language "moves away from the clarity of the U.S. definition by reintroducing deviation from accepted practices as misconduct rather than as the basis for finding misconduct," argues Fred Grinnell, director of the Ethics in Science and Medicine program at the University of Texas Southwestern Medical Center in Dallas. Adds ethics expert Howard K. Schachman, a biochemist at the University of California, Berkeley, "The definition of scientific misconduct presented in the Wellcome Trust document contains words and ideas that I think should be eliminated."

According to Chris B. Pascal, director of the U.S. Office of Research Integrity, Wellcome's definition of what constitutes misconduct—including "deliberate, dangerous or negligent deviations from accepted practices"—"is considerably broader" than the OSTP's definition. "In theory, it would be easier to show misconduct under Wellcome's definition" than under the U.S. definition, says Pascal, who notes that the OSTP rules are likely to go into effect

Scientific Misconduct: a Matter of Definition

The Wellcome Trust
"The fabrication, falsification, plagiarism or deception in proposing, carrying out or reporting results of research or deliberate, dangerous or negligent deviations from accepted practices in carrying out research. It includes failure to follow established protocols if this failure results in unreasonable risk or harm to humans, other vertebrates or the environment. ..."

U.S. government funding
"Fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results. ... Research misconduct does not include honest error or honest differences of opinion."

at several—but not all—U.S. departments by the end of this year.

One shortcoming in the Wellcome guidelines, contends microbial geneticist Herbert Arst of Imperial College in London, is their lack of strong provisions for protecting whistleblowers and ensuring that universities don't conduct cursory "whitewash inquiries" of misconduct allegations. Terry defends Wellcome's whistleblower section, explaining that its wording is limited partly by the U.K.'s strict libel laws, which make it easier for accused parties to win a defamation case.

Such concerns could be addressed in final guidelines set to go into effect in the fall of 2002. In addition to providing comments on the existing draft, due next month, the trust has asked organizations to describe how they deal with misconduct allegations. Oxford University's 2-year-old integrity code, for example, offers a relatively broad definition of misconduct and a set of procedures to pursue allegations. According to Wellcome, sanctions against a researcher found guilty of misconduct could range from a letter of reprimand to barring the individual from receiving trust funds "for a given period."

The Wellcome guidelines could trigger a rush among U.K. research outfits to follow suit, predicts Drummond Rennie, deputy editor of *The Journal of the American Medical Association*. Nor are the guidelines intended solely for biomedical scientists: "We're hoping that this also can become the template for guidelines in other fields of science," says Terry. In addition, Britain's research councils are weighing whether to require universities to adhere to "good practice" as outlined by the Medical Research Council. Although Wellcome does not have the power of a government agency, it does wield a sword of Damocles over universities and research institutes hesitant to enforce its planned rules: the threat of making them ineligible for Wellcome grants. –ROBERT KOENIG

MATERIALS SCIENCE

Silicon Lights the Way To Faster Data Flow

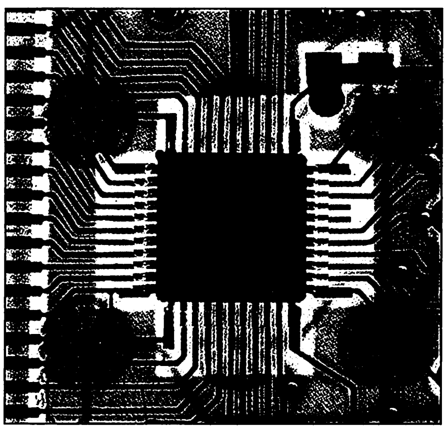
Computer engineers can design souped-up chips capable of performing billions of calculations per second. But their wizardry will be in vain unless they can also speed the flow of information between chips and other computer components. One way to do that is to replace today's sluggish metal wires with higher speed optical connections, using special semiconductors to convert electrical signals to a staccato of light pulses. Unfortunately, the best light-emitting semiconductors, such as gallium arsenide (GaAs), are hard to integrate with silicon, and the ideal material for the job—silicon itself—has been a poor light emitter.

Now Australian researchers have taken a big step toward making silicon shine. In this week's issue of *Nature*, physicist Martin Green and colleagues at the University of New South Wales in Sydney report a 100-fold boost in the efficiency of silicon-based light-emitting diodes (LEDs) using a trick for making solar cells. The devices still aren't as bright as ones made of GaAs. But there appears to be plenty of room for improvement. "If it can interact with transistors and memory, it would probably be really important," says Daniel Radack, who oversees advanced computing issues for the Defense Advanced Research Projects Agency in Arlington, Virginia.

Silicon, it turns out, does only a mediocre job of both absorbing and emitting light. For solar cells, which absorb light and convert it to electricity, the result is that much of the light that hits a cell passes right through the material. In recent years, Green and his colleagues have found that texturing the top and bottom surfaces of the cells causes light to bounce around inside the cell so it can be absorbed. The best light-absorbing semiconductors are also the best light emitters, Green says, giving him the idea that texturing silicon could improve the efficiency of silicon LEDs as well.

An LED works like a solar cell in reverse. Negatively charged electrons and positively charged "holes" are injected into the device. When they collide, they give off photons—in this case of infrared light—with wavelengths similar to the ones used in optical communications.

Silicon is actually pretty good at getting these charges to combine: About 10% of the injected charges produce photons. The problem is that usually only about 0.01% to 0.1% of the photons ever get out; the rest just create unwanted heat. To improve matters, Green's team created an array of pyramid-shaped wells on the silicon's top



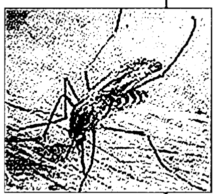
Bottleneck. Chips could communicate better if light beams replaced sluggish wires.

CREDITS: (TOP TO BOTTOM) USGS NATIONAL WILDLIFE HEALTH CENTER; KELLY HARRIGER/CORBIS

ScienceScope

North and South The West Nile virus continues to march across the North American continent at a breathtaking pace. This summer it has appeared in many places in the southern U.S. and in southern Canada, and local health authorities everywhere are stepping up surveillance and control efforts. The virus has also claimed its first victim this year, a 71-year-old woman from downtown Atlanta who died on 11 August. Three other elderly people—two in Florida, one in New York City—have fallen ill so far.

West Nile is a mosquito-borne virus that primarily infects birds but can be spread to humans and other mammals. Its first outbreak hit New York City in the summer 2 years ago. Last year it spread north to most states in New England and as far south as North Carolina. Now, the agent has also been found in dead birds in Georgia, Florida, and Louisiana. "It's made a big jump," says virologist Robert Tesh of the University of Texas Medical Branch in Galveston.



Canadian scientists who detected the virus in two dead birds form southern Ontario were still awaiting confirmation from an independent lab at press time. Although mosquito activity dwindles in the northern U.S. and Canada by fall, southern states may also see the disease through the winter, Tesh says. And at the rate the virus is advancing, he adds, "I wouldn't be surprised to see it in Houston by the end of the summer."

Stemming Research Confusion is rife in the wake of U.S. President George W. Bush's 9 August decision to allow limited stem cell research. Although the National Institutes of Health (NIH) says there are 60 lines of embryonic stem cells in existence, many researchers are skeptical of that number. Only seven of the lines have actually been described in the scientific literature. And *Science*, after conducting its own informal survey, came up with a maximum of 34.

Now the American Association for the Advancement of Science (AAAS, publisher of *Science*) is calling on NIH to let the world know promptly where the cell lines are that can be studied under the new guidelines.

"We believe it is essential that confusion over the actual number available be resolved as soon as possible," says the AAAS statement. "We strongly urge, therefore, that the administration make public immediately the identities of the sources of those stem cell lines." NIH officials say the White House will set up a registry, which lists all cell lines and how to obtain them, but no timetable for its completion has been set.