serve as models for human diseases (*Science*, 14 April 2000, p. 248). Over the past decade, some 2500 mutant mouse lines have been created or identified worldwide, including nearly 1000 in Germany and the U.K. alone. And although only a small fraction of the mutants are stored as living animals, the cost of maintaining their frozen embryos—about 500 of which need to be kept on hand for each mutant line—runs at least $4000 annually for each strain.

Expensive date. Maintaining embryos of mutant mouse strains can cost $4000 a year.

Yet the money is well spent, comments biochemist Adelbert Roscher of the University of Munich, who works with a group of German labs that recently created several dozen new mutants. "Mouse models are necessary initial steps for transferring the new knowledge coming out of genome programs into clinical use," he says. "The work of EMMA will speed up this process."

–MICHAEL BALTER

CONDENSED-MATTER PHYSICS

Switch-Hitter Materials Tantalize Theorists

At one point in the movie *Blade Runner*, the evil techno-mogul Eldon Tyrell presses a button that suddenly darkens his office windows. A science-fiction moment? In fact, physicists have known for years that by lacing certain simple compounds with hydrogen they can perform the opposite trick, turning shiny metal conductors into clear insulators.

Now a team of physicists and materials scientists has closed the loop. In the 4 June issue of *Physical Review Letters*, they report that they take the compounds—hydrides of the rare earth elements yttrium and lanthanum—and change them back into shiny conductors by flashing them with ultraviolet (UV) light. The UV-triggered switchable mirrors are intriguing both in their basic physics and for possible applications to optoelectronics, says co-author Tom Rosenbaum of the University of Chicago. "These are amazing materials."

The strange properties of hydrides first came to light 5 years ago, when researchers led by Ronald Griessen of Free University in Amsterdam were searching for new superconductors. His team looked at metal hydrides, materials that act like sponges capable of absorbing huge amounts of hydrogen. They didn't find superconductivity in samples of yttrium hydride, but they did discover that high-pressure hydrogen turned it from a shiny metallic YH_2 film to a transparent insulator made of YH_3.

In the latest work, the Amsterdam group has joined forces with physicists at Chicago and learned to trigger the reverse effect with light. They took a thin yttrium film sealed with palladium and placed it in a hydrogen pressure cell cooled to a temperature of 0.35 kelvin. By dosing it with hydrogen, they made the insulating compound YH_3 and monitored its electrical conductivity with tiny wires attached to the sample. When they flashed the film with a UV strobe light, the conductivity shot up—a sure sign that the insulating material had changed into a metallic form. "We can basically 'dope' this material with UV light," says Rosenbaum.

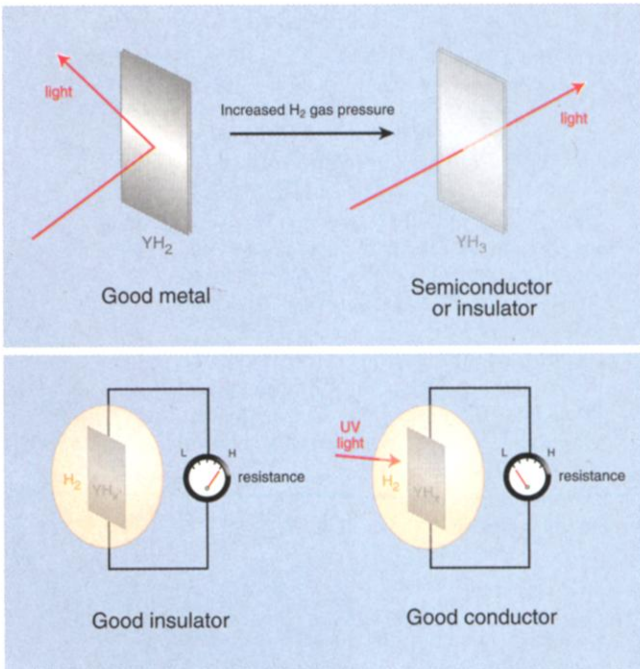
The results may help illuminate one of the toughest questions in condensed-matter physics: how materials go from metal to insulator and back again. Such transformations, called Mott transitions after the British physicist Neville Mott, who first tried to nail down the theory, have vexed researchers for years. Many of them are tied to basic changes in a material's crystal structure—changes that take place abruptly enough to pull the rug out from under researchers probing the mechanisms of how the electrons interact and influence the change from metal to insulator. As a result, says theorist Steve Girvin of Indiana University, Bloomington, "our theoretical understanding of the metal-insulator transition remains very poor and confused despite a lot of work on this."

But remarkably, the metal hydrides undergo a smooth, continuous transition rather than an abrupt one. That makes them a valuable test-bed for studying these peculiar quantum phase transitions. In one series of experiments, the researchers were able to extract so-called critical exponents—numbers that characterize how the conductivity changes with temperature and electron density in the hydrides. They discovered that the hydrides have unusually large exponents unlike those of any other metal-insulator transition. That may indicate that hydride transitions belong in a theoretical category, or universality class, all their own, Rosenbaum says. "Either we have a new universality class, or we really don't know how to do the theory yet. Either way, it's an interesting package."

Other physicists say it's premature to speculate about what the data from the hydrides mean; quantum phase transitions are still too difficult to understand, they caution. "It's a wonderful new system," says Subir Sachdev of Yale University, "but the interpretation of the critical exponents is less persuasive." Much more work needs to be done to make this part conclusive, he says. "For these transitions with disorder and strong electron interactions, nobody has a clue what is going on."

In addition to opening up some deep puzzles for condensed-matter physicists, the metal hydrides might provide an interesting material for practical applications. High-tech window shades aside, companies such as Phillips have already started looking at the hydrides for computer displays. The latest work, in which UV light triggers the switching of metal properties, hints at the possibility of light controlling light—a trick that researchers in fields such as optical computing and fiber-optical network switching are eager to master. Taming the rare earth hydrides and understanding their fundamental physics should keep researchers busy for some time to come.

–DAVID VOSS



Mirror, mirror. "Doped" with hydrogen or with ultraviolet light, yttrium hydrides acquire new optical and electrical properties.

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