ble disease for which there is no treatment. It is 100 percent penetrant, meaning if you have the gene, you get the disease. The mean age of [human] diagnosis is 4.6 years, and the average age at death is 17 years."

Screening for chemical compounds that will elevate PGC-1α in humans is now under way at the Broad Institute in Cambridge (see "Bigger Biology," November-December 2006, page 72), under the direction of Loeb professor of chemistry Stuart Schreiber. Because exercise is known to have beneficial effects throughout the body, and the PGC-1 genes are known to be under the control of exercise, there is also reason to believe that they may play important roles in tissues other than muscle—an intriguing possibility that Spiegelman intends to explore during the next few years. ~JONATHAN SHAW

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TRIPPING THE LIGHT

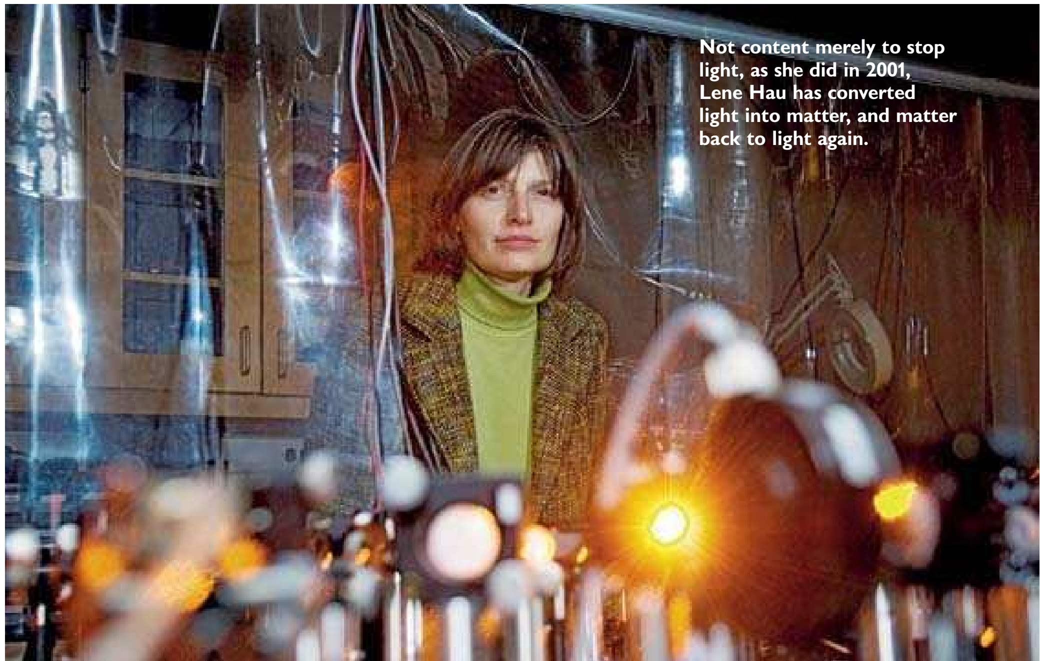
Fantastic!

THE RECENT announcement that Lene Vestergaard Hau had successfully changed light to matter, and then back into light, evokes the magic of carrying moonbeams home in a jar. That the general public might harbor doubts about the success of such research is understandable, but Hau says even her fellow physicists were skeptical. "My colleagues would say, 'Why would you even try these experiments? It won't work right,'" says Hau, Mallinckrodt professor of physics and of applied physics.

Her latest achievement builds upon a succession of discoveries that began at the Rowland Institute in Cambridge in 1999, when Hau's team first used supercooled sodium atoms to slow light pulses down to 38 miles per hour from their cruising speed of 186,000 miles per second. By 2001, Hau was able to halt the light pulse completely before sending it on its way.

In the spring of 2006, Hau began a new round of experiments, in the Cruft Laboratory at Harvard, using the same 5- by 16-foot optics table that she had used to slow and stop light. The table floats on high-pressure air and, Hau says, is "absolutely filled to the brim with optics and optical gizmos, laser systems and vacuum systems and electronics everywhere." In the midst of an experiment, lasers criss-cross the table, lighting up the room. "We have people come into the lab who say, 'My God, it looks like a Christmas tree,'" she adds.

The lasers do more than delight onlookers. One set works to illuminate the experiment in progress, allowing the team to create images and measurements of the test; others are tuned to a specific frequency and focused on two tiny "clouds" or "pools" of neutral sodium atoms (each pool only a tenth of a millimeter in diameter), in order to cool their temperatures to within a few billionths of a degree above absolute zero. At this temperature, Hau says, the atoms in the pools begin to act in lockstep—a phase referred to as a Bose-Einstein condensate. Once the pools have cooled, the researchers use electromagnets to hold the viscous mass of atoms in place at a constant temperature.



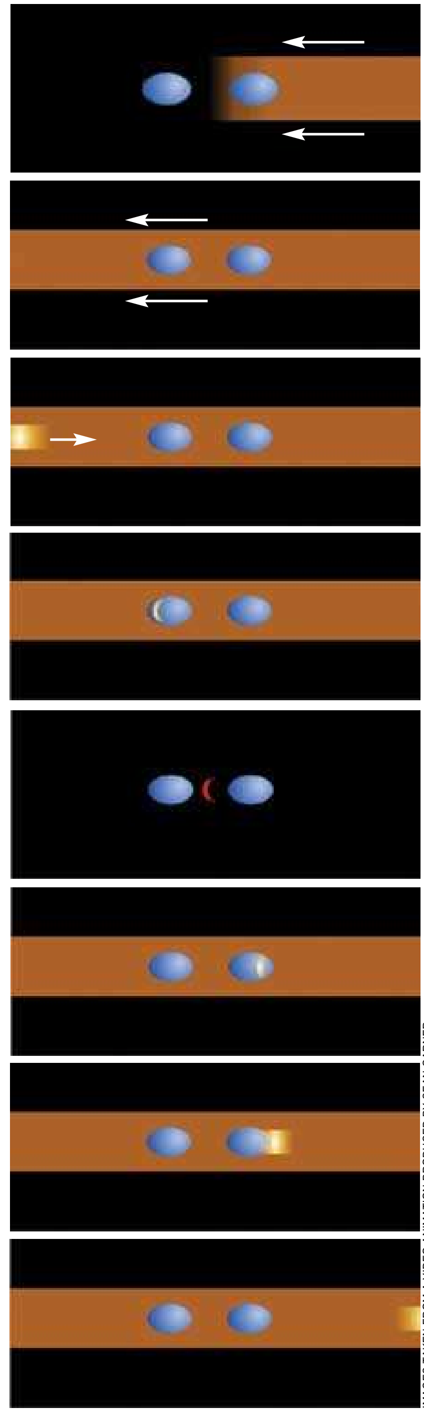
Not content merely to stop light, as she did in 2001, Lene Hau has converted light into matter, and matter back to light again.

JODI HILTON

With both of the condensate pools cooled and kept about two-tenths of a millimeter apart, another laser is turned on for a few millionths of a second, emitting roughly a kilometer's worth of light pulse. When this pulse enters the first pool, the condensate applies the brakes. The light is slowed down to 15 miles per hour and contracts to less than one-thousandth of an inch. Then, as the pulse begins to make its way across the first pool, what Hau describes as "a little boomerang shape" takes form: a matter imprint of the light pulse—traveling at "a slow walking speed" of 700 feet an hour—leaves the first pool and "strolls out" into free space. When it reaches the second pool, the firing of another laser revives the pulse, which revs back up to its normal speed and heads back on its way.

"In effect, we have extinguished the original light pulse in the first atom cloud and now we have, out in free space, a perfect matter copy of the original light pulse," says Hau. "We can take it out, put it on the shelf, and revive it later on."

And that matter—that little boomerang of sodium atoms moving between



IMAGES TAKEN FROM A VIDEO ANIMATION PRODUCED BY SEAN GARNER

From the top: Laser light coming in from the right (frames one and two) illuminates two "pools" of supercooled sodium atoms. Then a quick pulse of laser light coming in from the left (frame three) enters the first pool (frame four), forming a crescent-shaped matter wave, which traverses the free space between the pools (frame five). Once the wave has entered the second pool (frame six), a second laser light "revives" the matter pulse, turning it back into light (frame seven) that speeds away (frame 8) at 186,000 miles per second.

the two pools—offers countless future breakthroughs, Hau says. In conjunction with her earlier research, this new discovery draws a blueprint for a quantum computer. "With our early experiments, we made the memory," she says. "Now, in this experiment, where we can intentionally change the optical information, we can start to make the processing unit." Future computers, instead of relying on electrical impulses, could rely on this type of light-form data, she explains. This would allow not only for faster transfer of information, but for more secure data, because any attempt to decode the information would change the state of the matter, making intercepts easy to detect. Superfast, superpowered quantum computers would also be able to encode light data with massive algorithms that even a supercomputer would need years to decipher, providing an additional layer of security.

"There are so many things we can start to do—it's just a matter of, 'Oh gee, what should we pick?'" says Hau. Whatever the choice may be, it's likely that this time, her colleagues—doubters no more—will be watching closely. ~DANIEL MORRELL

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NOT SO SECULAR

Faculty Faith

In their early years, many American universities had openly religious agendas. Harvard's own mission, according to a 1643 pamphlet, was "To advance *Learning* and perpetuate it to Posterity; dreading to leave an illiterate Ministery [sic] to the Churches." But in the centuries that followed, professors began to see their mandate as seeking secular truth, rather than spreading the Gospel. Today, it may seem that religion has been very nearly banished from the ivory tower.

"There's a way in which you imagine academicians developing their social and political attitudes in a realm of pure rationality devoid [of religious] concerns and entanglements," says assistant professor of sociology Neil Gross, who coauthored a study of professors' religious beliefs that will appear as a chapter in the forthcoming book *The American University in a Postsecular Age.* "Of course," he adds, "we find that that's not the case. Academics are social actors, just like everyone else."

Last spring, in a survey of 1,500 professors (from dozens of fields, working at community colleges, four-year colleges, and elite research universities, denominational and otherwise), Gross and a colleague, Solon Simmons of George Mason University, asked about their respondents' political and social views. They found that more than half of the academics believe in God and less than a quarter are either atheist or agnostic.

The numbers surprised them, "particularly given that religion is not something that most professors talk about too much with their peers," says Gross. "I think it's something that most academicians think of as a private matter, something that doesn't have much of a place in departmental discussions, or in research." (Though comparatively low, the percentage of nonbelievers in academia is still much higher than the percentage of self-described nonbelievers found among the general public. That figure is only about 7 percent, according to the nationwide General Social Survey, issued by the National Opinion Research Center at the University of Chicago.)

Just as surprising to the researchers was the range of belief across institutions and fields of research. Although nearly 37 percent of professors at elite research schools like Harvard are atheist or agnostic, about 20 percent of their colleagues have "no doubt that God exists." At community colleges, in contrast, 15 percent of professors are atheist or agnostic,

Illustration by Diane Fenster