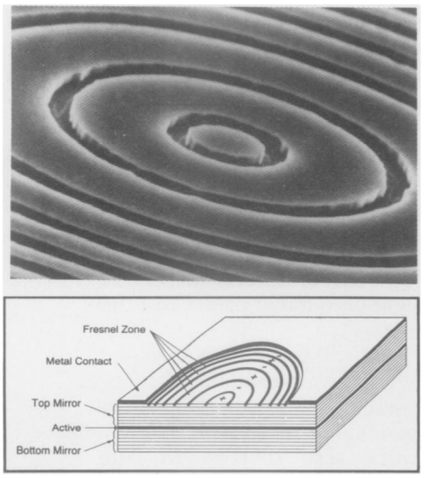
Solid-state lasers: Upward to a focus

The tiny laser in a compact disk player or a laser printer generates light from the excitation of electrons in an active layer of a sandwich of semiconducting materials. Such a laser typically feeds a ribbon of light sideways out of the active layer. An external lens then focuses this light.

Now, researchers at AT&T Bell Laboratories in Murray Hill, N.J., have developed a new type of semiconductor laser that



AT&T Bell Labs

Pattern of grooves, seen in an electron micrograph (top), etched into the top surface of a semiconductor laser brings infrared light generated in its active layer (bottom) to a focus above the surface.

automatically focuses light emerging from the top rather than from the edge of the semiconductor sandwich. This is the first laser that can focus itself, Bell Labs researchers say.

A compact source of focused light such as this could facilitate the passage of light from a laser into an optical fiber or between optical components on a single integrated-circuit chip or on separate circuit boards. "For these applications and others requiring coupling to fibers, a laser source with a converging output would be preferable to any laser in commercial use today," says Daryoosh Vakhshoori, who invented the device.

Known as a zone laser, this experimental device consists of several layers — each 70 angstroms thick — of indium gallium arsenide, gallium arsenide, and aluminum gallium arsenide. About 120 micrometers in diameter, this experimental laser produces infrared light. A pattern of concentric grooves — each 1 micrometer wide and about 0.35 micrometer deep — cut into the laser's top surface focuses the light to a spot 8 micrometers wide.

The researchers will describe their self-focusing laser at next month's International Electronic Devices meeting in Washington, D.C. *— I. Peterson*

A dry film makes a very hot photo debut

A photographic film that doesn't need silver or developing chemicals may soon appear in commercial print shops.

Called VerdeFilm by its developer, Xerox Corp., the new film replaces silver halide with a selenium-based compound that reacts to light only when the film is under an electric charge. The new product's chief advantage, the company says, is that it eliminates the multistage chemical processing required by most conventional photographic films.

"This is a dry process," says Edward H. Ernst, general manager of Verde Print Technologies, a Xerox division. "No wet chemicals or effluents are added to or taken away from the film."

The process is based on electrophotography, Ernst says. The film consists of a sheet of aluminized mylar with a 1-micrometer-thick layer of a heat-sensitive polymer. Embedded in the polymer are selenium particles. Unaffected by light in its resting state, the film becomes photosensitive only when subjected to an electrical charge. Then, when exposed to light and gently heated, the film reveals an image — a process akin to that used in laser printing.

"By putting the film in an electric field and exposing it to light, the film's photoconducting particles become charged," Ernst says. "When you heat the film, the charged particles migrate toward the back of the film, toward the aluminized mylar, which acts as an electrode. Finally, when the film cools, the particles stay fixed in their new positions, leaving a permanent image."

Casual exposure to light doesn't wreck the film — another advantage. "Loading this film is like dropping paper into a laser printer," says Ernst.

In its current form, VerdeFilm will prove most useful for high-resolution black-and-white "intermediate master images," used by industrial printers to make magazines, catalogs, and posters. Xerox reports no plans to market a color VerdeFilm or consumer version.

The name VerdeFilm implies a "green," or environmentally friendly, technology, says Xerox spokesman John Rasor, in line with the company's goal of reducing the hazardous effluents common to silver-halide photography. California has classified the new film as "casually disposable," Xerox reports, with selenium leakage below detection levels. The company also plans to recycle exposed film, removing the selenium for reuse.

— R. Lipkin

Miniature pumpkins harbor puffable seeds

What did you do with the innards of last week's jack-o-lantern? Most households pitched the slippery, seed-bearing strings as they carved their pumpkin. But if Brent Loy has his way, Halloween squashes may attract more culinary attention as the source of a homegrown, popcorn-like snack food.

A plant breeder at the University of New Hampshire in Durham, Loy has focused his efforts over the past 11 years on developing a fruit that growers will prize for its seeds. Though pumpkin seeds are tasty, Loy says, getting to them requires cutting or biting off the tough protective hull that encases them. Unless, that is, your pumpkin eliminates the hull for you. And Loy's hybrids do.

An Austrian researcher discovered the gene coding for hull-less pumpkin seeds in 1933. Since then, Loy says, Eastern European growers have bred squashes with such seeds as alternatives to rapeseed (canola) and olives, two sources of cooking oil rich in monounsaturated fat.

But the small seeds or low yields of these cultivars won few converts in the United States. So Loy decided to beef up the seeds by trimming down the pumpkin. His goal: peanut-size seeds that, as a high-protein snack, might gain a toehold in the lucrative munchies market.

Loy

Minipumpkin's stripped seeds.

One fruit of those labors — a hybrid he calls Snackjack — is currently being grown for commercial introduction, perhaps in 1995. His hybrid's seeds "are up around 40 percent protein," Loy says. Though typically about 45 percent fat by weight, the hull-less seeds are almost free of saturated fat and contain a 1:3 ratio of mono- to polyunsaturates.

"I've developed the plant to produce cute ornamental pumpkins," Loy says. At about 1.5 pounds, the thin-skinned fruit measures only about 5 inches in diameter, yet produces 300 to 400 seeds. In field trials it yielded about 1,500 to 2,000 pounds of seed per acre.

What do you do with those seeds? Eat them dry and salted, he suggests. Better yet, toast them in the microwave oven, where Loy promises they'll puff up like popcorn. *— J. Raloff*