formally putting the word out about the candidate, hoping some other group will produce confirmation—confirmation that is essential because of the 1989 false alarm. "The standard of proof is now two or three times the usual," says Robert Kirshner, a supernova expert at the Harvard-Smithsonian Center for Astrophysics (CFA).

It isn't that astronomers want to disprove the pulsar's existence; on the contrary, they've been longing to detect it since 1987a first appeared. "Where is the pulsar? It's one of the most exciting questions around," says the University of Wisconsin's Hakki Ogleman, a member of a European Southern Observatory team monitoring 1987a that has yet to confirm the new candidate. Catching a pulsar right after its birth has never been done, he explains, and observations would allow astronomers to fine-tune their largely theoretical models of how these objects form out of the collapsed core of an exploding star.

Middleditch's team plans further observations of 1987a in Chile in November and February. A few members of the group at CFA are also rushing to complete a new infrared detector that might offer a better view through the supernova's obscuring debris than do instruments that detect photons at visible wavelengths. That debris, in fact, may explain why the putative pulsar has temporarily disappeared. Other astronomers say they're hoping this is the case, for it would be cruel and unusual punishment for Middleditch and his co-workers if this turns out to be another false alarm. "It would be kind of like lightning striking twice," says University of Illinois astronomer Frederick Lamb.

–John Travis

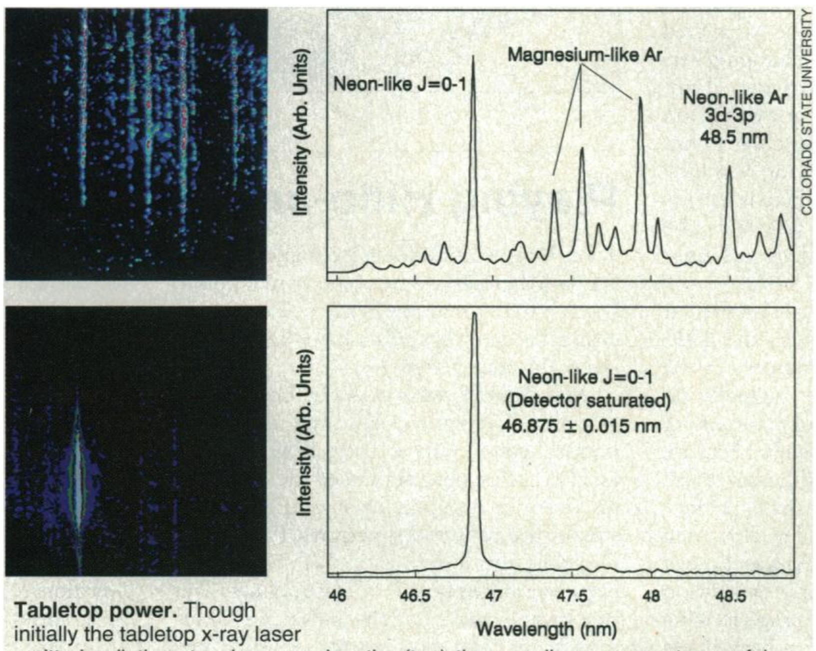
PHYSICS

Putting X-ray Lasers on the Table

Cutting out the middleman is a time-honored technique for reducing the cost and complexity of commercial transactions. Sometimes it works in physics, too. That, at least, is one conclusion that could be drawn from the successful demonstration of the first tabletop-sized, so-called "soft" x-ray laser (XRL), driven by a simple electrical discharge.

Scientists have been hankering for such equipment because soft x-rays—which are about 100 times less energetic than "hard" x-rays—have much shorter wavelengths than visible light does, and therefore can act on a much smaller scale. In biology, for instance, microscopes based on x-ray laser sources could provide higher resolutions than optical instruments do, while avoiding much of the specimen preparation necessary with electron microscopes—preparation that can alter microstructural details.

But previously, most XRLs incorporated expensive, room-sized, high-power optical lasers as energy sources. By eliminating the optical laser and replacing it with a simple electrical capacitor, Jorge Rocca and his colleagues in the electrical engineering department at Colorado State University in Fort Collins reported in the 17 October issue of *Physical Review Letters* that they have dramatically reduced the size and cost of the XRL equipment. The new machine is about the size of a large refrigerator. This downsizing is a "giant step," says Steve Harris, an x-ray researcher in the department of applied physics at Stanford University.



Tabletop power. Though initially the tabletop x-ray laser emitted radiation at various wavelengths *(top)*, the x-ray line grew most powerful when lasing conditions were improved *(bottom)*.

Lasers can create a beam of powerful, single-wavelength light when photons with various energies zip through a plasma of ions that have been pushed to a high energy level—say, through bombardment by hot electrons. Under the right conditions, these ions can be primed to release a photon with a specific energy and direction when "tickled" by the passage of an identical photon: As this process continues, the photons multiply and become an amplified pulse of coherent light. The first XRLs were demonstrated at Lawrence Livermore National Laboratory and Princeton University in 1984. Both prototypes used ungainly optical pump lasers to create the plasma (the Princeton version was the size of two offices). Since then, several groups have tried to shrink the necessary hardware by using the smaller optical lasers that have recently become available, but the XRL results so far have been mixed at best.

Rocca and colleagues reasoned that an electrical discharge could be coaxed into producing a hot plasma directly, eliminating the optical laser. The team first rapidly discharged a capacitor between electrodes at either end of a 4-millimeter-wide polyacetal plastic tube filled with argon gas. The 100-joule discharge stripped electrons from atoms in the gas and heated them, just as the optical lasers had, and the magnetic field generated by the current squeezed the plasma to a fraction of a millimeter.

As the hot electrons struck argon ions in the plasma, the ions were driven into excited states while randomly emitting photons of many energies. Among the randomly emitted photons were some at x-ray lasing energies, and their numbers avalanched along the tube. And the longer the tube—the team looked at lengths from 3 to 12 centimeters—the more x-ray photons were made, eventually producing a beam with laser characteristics.

Other laser scientists are impressed with the smaller, faster, cheaper effort. "In comparison to the laser-pump guys, [Rocca] uses garage technology," says Howard Milchberg, a laser researcher at the University of Maryland, College Park. Milchberg and others point out, though, that Rocca's laser can now produce x-rays of only 470 angstroms. Hard x-rays, of only a few angstroms in length, are of much higher energies and still require the power of an optical laser-pumped XRL to generate them. Rocca concedes the point—for now. But he's already working on ways to produce shorter wavelengths—eventually, perhaps, as short as 50 angstroms—using his "garage" setup. He argues, however, that the wavelengths he can already produce should be useful for imaging and other purposes. "There's a lot of stuff you can do with [these] photons," he says.

–James Glanz

James Glanz is a science writer based in Chicago.