lived isotopes, whereas ISOL provides lower-emittance and lower-divergence beams but only for isotope half-lives of milliseconds or longer. Like TRIUMF, CERN's ISOLDE uses ISOL, while radioactive-beam facilities at Michigan State University, the Heavy Ion Research Center in Darmstadt, Germany, and Japan's RIKEN use fragmentation.

For now, ISAC-II "brings to the table both high-power production and really good post-[selection] acceleration," says Argonne National Laboratory's Jerry Nolen, a member of the design team for the US's proposed Rare Isotope Accelerator. But, he adds, "the intensity and variety of beams even at ISAC-II is not enough to make many of the neutron-rich rare isotopes that are important for understanding things like supernovae." That, says Nolen, will have to wait for RIA, which, if built, would be outfitted for both ISOL and fragmentation and would make twice as many species of isotopes as ISAC-II. Earlier this year, however, the US Department of Energy formed a committee to reevaluate the importance of radioactive-beam science, and asked scientists to come up with a cheaper, scaled-down project—informally called the "advanced exotic beam facility." In its original conception, the $1 billion RIA "would have been a world-dominating facility," says Nolen. "We are still looking for a major role, but in an area that complements what goes on elsewhere."

"In some ways we are leading the way [with ISAC-II]," says Ball. "We get all those beams at a continuously variable energy. There will be no one else in our energy range for several years. This is our window."

Toni Feder

First optical telescope dedicated to SETI begins operation

Almost 50 years ago, Philip Morrison and Giuseppe Cocconi famously suggested that the most likely electromagnetic wavelength at which an advanced alien civilization would try to signal its existence is the ubiquitous 21-cm microwave emission line of neutral atomic hydrogen. And until recently, the search for extraterrestrial intelligence (SETI) has been conducted almost exclusively by radio astronomers sifting through 21-cm radiation from space in search of anything that might be a message.

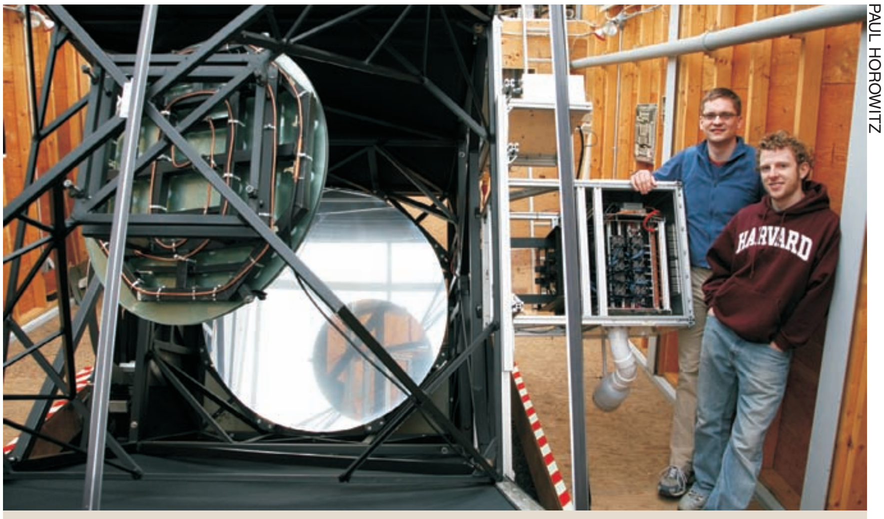
Half a century ago, the 21-cm line was the only known interstellar microwave emission line, and lasers had not yet been developed. Since then, radio astronomers have found many shorter-wavelength microwave lines that would serve better because they suffer less interstellar dispersion. Furthermore, today's laser technology makes it possible for petawatt (10^{15} W) lasers to emit highly collimated nanosecond optical pulses that briefly outshine the Sun by a factor of 10 000. Because no known astrophysical source could put out a bright nanosecond optical pulse, some SETI searchers have concluded that looking for signals from technologically advanced aliens is more promising with optical telescopes than with radio telescopes.

The optical search for extraterrestrial intelligence—called OSETI—now has its first dedicated telescope. Completed in April and already in operation, the Planetary Society's Optical SETI Telescope at the Oak Ridge Observatory in Massachusetts is directed by Harvard University physicist Paul Horowitz. Its 1.8-m primary mirror is, despite its modest size, the largest of any US optical telescope east of the Mississippi.

Horowitz and his OSETI collaborators had been observing parasitically on the observatory's 1.5-m Wyeth Telescope for six years. In that time they searched some 5000 sunlike stars within 1000 light-years of Earth for bright nanosecond pulses (see A. Howard et al., *Astrophys. J.*, **613**, 1270, 2004). "With the new instrument, we exceeded that total in the first few hours," says Horowitz. That's primarily because the new telescope, optimized for OSETI, has a much larger field of view, monitored by an array of about a thousand ultrahigh-speed photodetectors. The group expects to cover the entire celestial sphere (except for far southern precincts inaccessible at the latitude of Massachusetts) within a year or two. The telescope monitors any one star for about a minute as Earth's rotation takes it across the field of view.

The project's cost, less than $400 000, was borne mostly by the Planetary Society. "It's so inexpensive," says Horowitz, "because all we need for OSETI is an efficient photon bucket." The telescope's two-arcminute angular resolution is no better than that of the human eye. But it suffices for the purpose. And one is not looking for spectroscopic precision or for the kind of phase-encoded messaging one seeks with radio-telescope heterodyning.

How could a petawatt laser call attention to itself over interstellar distances by outshining the Sun? Current optical technology can collimate the output of a petawatt laser at the top of the atmosphere into a beam whose angular spread $\Delta\theta$ is only 10^{-7} radians. All of the pulse's power is therefore concentrated on $(\Delta\theta)^2/4\pi$, or $1/10^{15}$, of the celestial sphere. Distant observers who happen to be within the spread of that beam would see a nanosecond pulse



PAUL HOROWITZ

The new Optical SETI Telescope at the Oak Ridge Observatory in Massachusetts is the first optical telescope dedicated to the search for extraterrestrial intelligence. Its 1.8-m primary mirror (seen face-on) directs light via a secondary mirror onto the photodetector array next to Harvard graduate students Andrew Howard and Curtis Mead.

much brighter than our parent star. But observers outside the beam would see no pulse. Presumably, thinks Horowitz, an alien civilization seeking contact would direct such a pulsed beam at one promising star system after another. The beam could be made wide enough to cover a diameter of many Earth orbits.

"If we find nanosecond pulses, we can't lose," says Horowitz. "If it's not from an alien civilization, at least we will have discovered an astrophysical phenomenon that no one anticipated. Not a bad consolation prize."

Bertram Schwarzschild

Atlas shrugged off at Nevada Test Site

After spending more than $100 million on Atlas, the US Department of Energy (DOE) pulled the plug on 1 June, sacrificing the barely used pulsed-power machine, which studied nonnuclear materials at high pressure, temperature, and magnetic field, in favor of subcritical experiments, which use plutonium but stay clear of nuclear-explosion-causing chain reactions.

Atlas, which symmetrically implodes cylindrical targets, was built at Los Alamos National Laboratory (LANL) in New Mexico and was used there in 2001–02 before being moved to the Nevada Test Site (NTS; see PHYSICS TODAY, July 2001, page 28). With delays—due in part to lab shutdowns in 2004 (see PHYSICS TODAY, November 2004, page 31)—it took until last summer to bring the machine back on line.

The expected lifetime of the machine is 1000 experiments, but it's been used for only a couple dozen, says LANL Atlas project director Robert Reinovsky. Since reopening at NTS, he adds, Atlas has focused on three series of experiments. They involve hydrodynamic mixing, material damage, and high-velocity friction between two surfaces sliding past each other. The results, Reinovsky says, "are provocative." The friction experiments, he adds, "can only be done at Atlas."

The machine is being mothballed because of a shrinking budget, says Mary Hockaday, LANL's acting program director for experimental physics. Atlas provides excellent data, but it's not the top priority, she says. "It becomes the first to go when you don't have money to get what you need." What's needed first for stockpile stewardship, DOE's program for maintaining nuclear weapons without testing, is plutonium data, Hockaday says. If Atlas becomes a priority again, she adds, it could be restarted.

Running Atlas costs around $7 million a year, plus $250 000 to $300 000 per experiment. Hockaday grants that the amount of money being transferred to subcritical experiments is small, but she says, "the biggest issue is that we can-

LANL—IM DIVISION

Unplugged: The Atlas pulsed-power machine, now located at the Nevada Test Site.