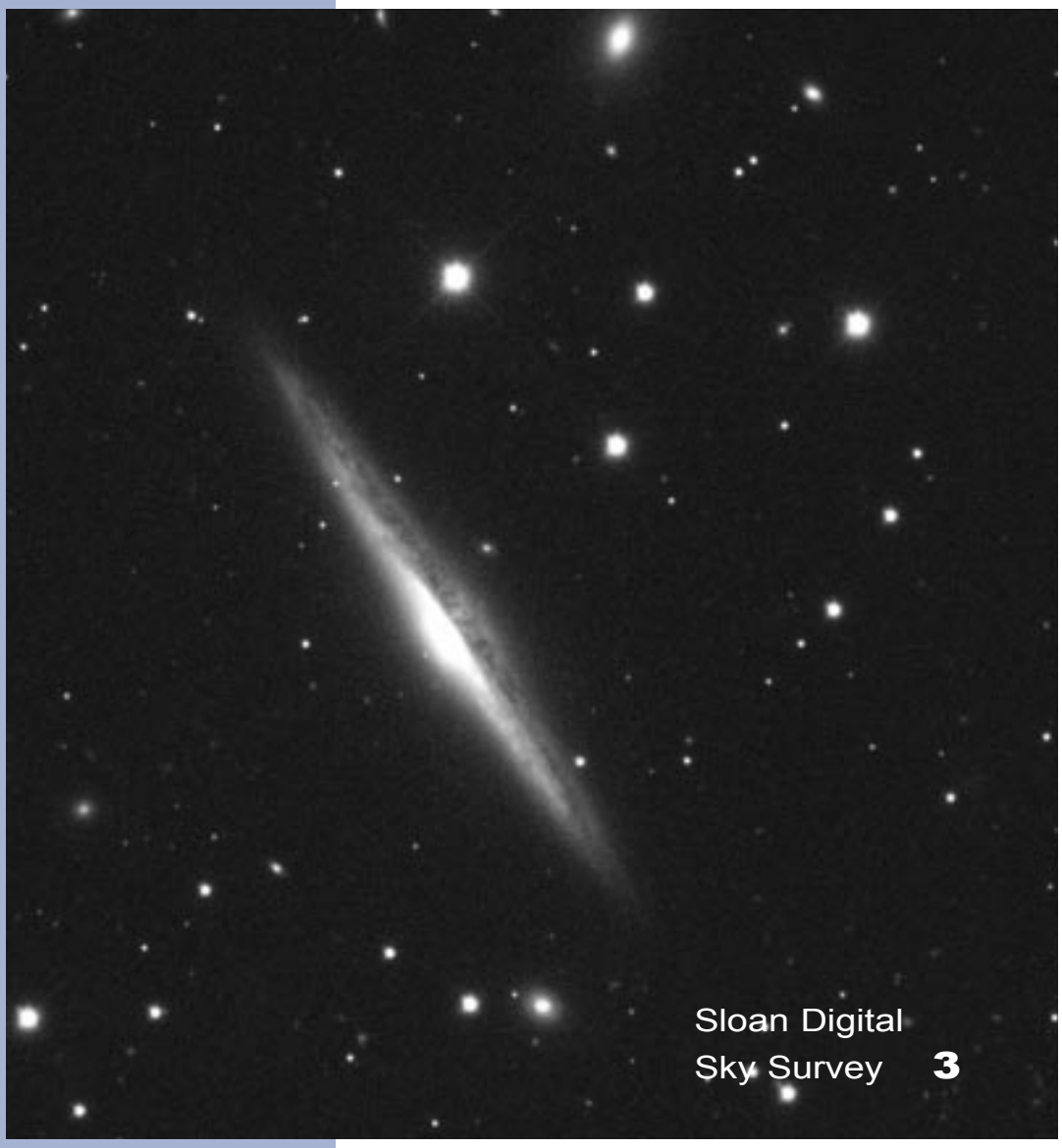
FERMI NEWS

FERMILAB A U.S. DEPARTMENT OF ENERGY LABORATORY



Sloan Digital Sky Survey 3

Volume 22
Friday, January 8, 1999
Number 1

INSIDE:

1969

1978

1981

1990

1992

1994

1998

Ferminews, which began in 1969 as *The Village Crier* (named for the original Fermilab "Village"), now has a circulation of more than 8,000 readers worldwide.

Here at Fermilab, we've opened the new year with a sense of anticipation. After an ambitious and complicated shutdown, after months of digging, installing, aligning and testing, the commissioning of the Main Injector is nearly finished. The Tevatron will soon crank up again, sending beam to three fixed-target experiments. NuMI is breaking ground this spring for its neutrino project, and preparations at the two collider detectors signal the coming of Run II. Meanwhile, results from the 1996-1997 physics run are beginning to pour in.

We thought it appropriate, then, to mark the new year with a new *Ferminews*.

With this issue, we bring you

- a new feature to draw you closer to life at the Lab (see p. 12);
- a new design to brighten these pages; and
- a splash of color to celebrate the events of the years to come.

Sharon Butler
Editor

The First Slice of Pi

THE SLOAN DIGITAL SKY SURVEY HAS NOT YET FORMALLY BEGUN—YET IT'S ALREADY FOUND THE MOST-DISTANT QUASAR EVER OBSERVED.

by Sharon Butler

Heidi Newberg, one of the astrophysicists working on the Sloan Digital Sky Survey, used to title her talks about the project "Pi in the Sky"—"pi" for the pi steradians, or 10,000 square degrees, that the survey plans to cover; "pi in the sky" for the then-elusive goal of charting an entire quadrant of the sky.

These days, however, Newberg calls her talks "The First Slice of Pi."

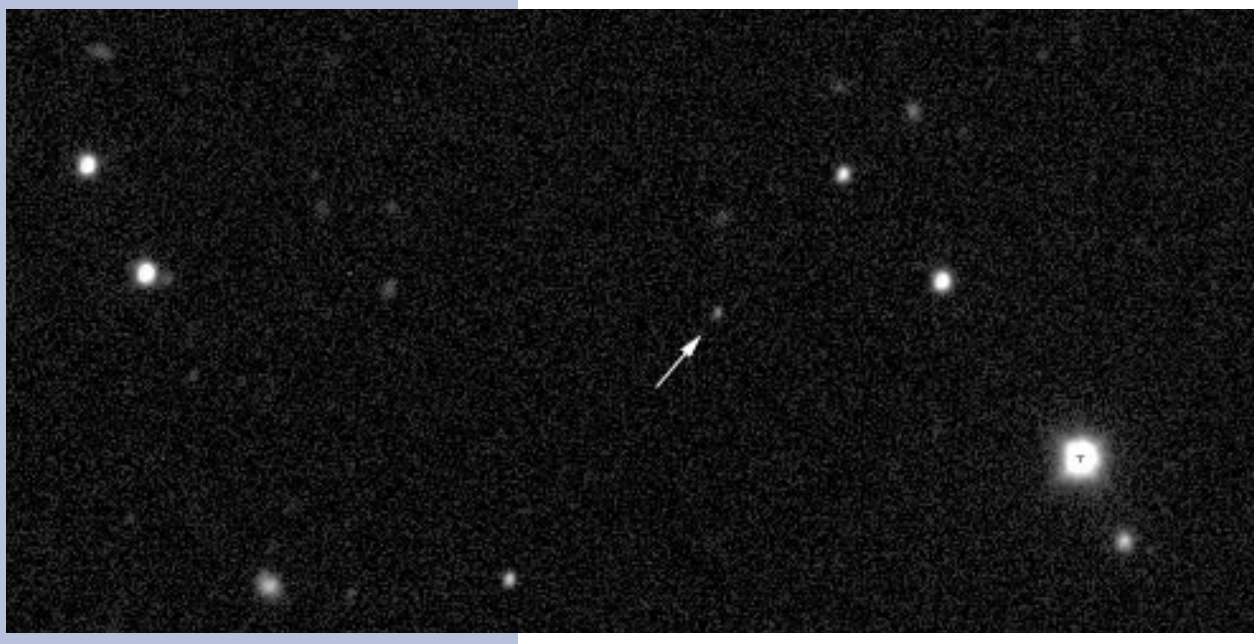
And what a slice it is.

At a collaboration meeting on December 4, held at Fermilab, the Sloan scientists announced that just days before they had discovered the most-distant quasar ever observed. Its redshift of 5 signifies that the light of the quasar had arrived from an ancient epoch when the universe was less than a billion years old and one-sixth its current size.

Neta Bahcall, a member of the Sloan collaboration from Princeton University, said that the finding was "really just the most exciting thing," all the more so because the survey has obtained images of only one percent of the area it will eventually chart—only a tiny slice of that pi. Astronomers have been looking for quasars this remote for more than a decade.

What's more, the discovery came before the survey was even formally under way. Scientists at the Apache Point Observatory in New Mexico were still commissioning the telescope, calibrating instruments, building data archives and installing a new monitor telescope when, at 1:30 a.m. on Thanksgiving morning, Princeton University graduate student Xiaohui Fan and his advisor Michael Strauss took the spectrum measuring the quasar's remarkable redshift.

"We could identify quasars so readily," Fan said, "because of the survey's unique characteristics: its superb telescope and camera, the power of its analysis software, and the large area of sky it covers."

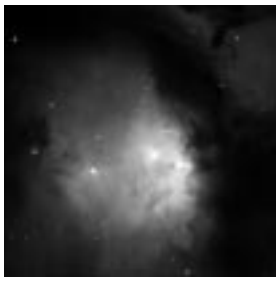


Sloan Photo

The unassuming dot (see arrow) is, at a redshift of 5, the most-distant quasar ever observed.

Photo by Fred Ullrich

Apache Point Observatory in the Sacramento Mountains of New Mexico. The Sloan Digital Sky Survey's 2.5-meter telescope is on the left. The monitor telescope, used for calibrations, is inside the small domed structure.



Sloan Photo

In this reflection nebula in the Orion constellation, hot young stars illuminate and, to a much lesser extent, ionize surrounding gas.

Quasars, or quasi stellar objects as they were originally called, are strange. They pack the luminosity of more than 100 galaxies inside a space no bigger than a solar system. The intensity of their light makes them the ideal objects for looking deep into the recesses of time, but perplexes scientists. Current theory proposes that quasars are powered by massive black holes whose energy comes from intensely hot material plummeting into their depths. How these black holes came about, however, is anyone's guess. Scientists are also puzzled by the fact that quasars apparently were once relatively common in the universe, but now are rare.

"No theory yet exists on how and when quasars were born and why they then faded away," said Richard Kron, head of Fermilab's Experimental Astrophysics Group and one of the Sloan scientists. The survey, he said, would piece together a theoretical framework from empirical data on how many quasars there are, how they are distributed, what they are made of and how bright they are. That theoretical framework will in turn help guide new research.

The scientists involved in the survey insisted that their discovery of the most-distant quasar was not the work of chance. It was instead, they said, the result of careful planning and design—for example, complex simulations to enable computers to identify important features in stars and galaxies, and the inclusion of a z-band filter in the telescope's camera, sensitive to the intensely red infrared light emitted by far-off quasars speeding away from us as the universe expands. The Sloan survey is capable of finding quasars with redshifts as high as 6.5—if they exist.

Besides finding the record-breaking quasar, the survey has also identified quasars with redshifts of 4.9 and 4.75 (thus, three of the four most-distant quasars ever observed), as well as a hybrid galaxy containing a mix of both very old and very young stars, and a nearby asteroid lying between Mars and Jupiter. Scientists are still analyzing the data from this first slice of the sky, but these early successes have confirmed that the telescope is performing according to expectations.

There was no doubt among the scientists assembled at Fermilab that the collaboration would be able to achieve the scientific goals it intended: mapping a quarter of the sky in unprecedented three-dimensional detail and getting an accurate census of the celestial objects that reside in that area of space. The information will ultimately help astronomers understand the large-scale structure of the universe and how it emerged.

Fan, who presented the quasar data, assured his colleagues that there were "many, many more exciting results to come in the years ahead."

He wasn't the only one brimming with confidence.

"Since day one in this project, we've assumed that the data would be so complex and overwhelming that it would take us a while to (a) understand and (b) calibrate the equipment correctly," said Jeff Pier, of the U.S. Naval Observatory. "We'll be learning as we go, refining our parameters and doing even better."

When one scientist pointed out that the redshift-5 quasar was not the oldest object ever observed (an even more-distant galaxy was discovered within the last year), Kron responded candidly: "But we can change that."

And no one in the collaboration disagreed.

Photo by Peter Kiar

Rich Kron, head of Fermilab's Experimental Astrophysics Group and a scientist in the Sloan Digital Sky Survey, threads fiber optic cables into plug plates for spectrographic observations.

Photo by Reidar Hahn

GETTING SCIENCE DONE

by Judy Jackson

As a kid growing up on Chicago's South Side, Andy Mravca used to take apart the shoe-repair machines in his father's cobbler shop to see how they worked. A few decades later, as a U.S. Department of Energy manager, Mravca helped put together the machines that define Fermi National Accelerator Laboratory, in a 25-year partnership that worked just fine.

"I don't think there would have been a Doubler without Andy," said former Fermilab Associate Director Dick Lundy, using an old name for Fermilab's Tevatron particle accelerator. "The support that he gave us was crucial in building it. And without the Doubler, Fermilab would have simply withered away."

Lundy and three Fermilab colleagues were awarded the Presidential Medal of Technology for their work on the Tevatron in 1989. Mravca's retirement as manager of DOE's Fermi Group, the Department's on-site office, prompted another of the Tevatron medal winners, former Associate Director Rich Orr, to recall the unique contribution Mravca made to particle physics research at Fermilab from the time he arrived at the infant high-energy laboratory in 1968.

"Andy resonated with [founding director] Bob Wilson," Orr said. "Andy was one of the main reasons the Lab got built. He was critical. In a very real sense, he was one of the founders of Fermilab. Andy always understood the purpose of what we were doing. He understood the sacred trust of keeping basic science research alive in this country."

Mravca arrived at Fermilab in July 1968, a young mechanical and nuclear engineer who had begun his career with the Atomic Energy Commission, DOE's predecessor agency, immediately after receiving an engineering degree from the Illinois Institute of Technology. Mravca and Fermilab immediately took to each other.

"It was so much fun," Mravca recalled recently. "Those were pioneering days. We were building a brand-new laboratory on a greenfield site. We used to work day and night.

"Wilson had promised Congress to build the Main Ring in five years for $250 million. No one thought the Laboratory could do it. In the end, not only did they do it, but we were able to turn $6.5 million back to the government."

In 1973, with Fermilab's first accelerator complete and in operation, Mravca left the Laboratory to administer other DOE projects for the Department's nuclear reactor program.

The retirement of DOE's Fermi Group Manager Andy Mravca on January 2 marked the end of a **unique partnership** that helped determine Fermilab's character as a national laboratory.

"Before long," Orr said, "we demanded that he be sent back. We said 'Send Andy back or else!'"

And in 1980, back he came, as area manager of the DOE site office at the Laboratory, just as Fermilab was embarking on the construction of a new accelerator, the Doubler, another project with the odds against it. Many doubted its chances because it required new and groundbreaking technology and because it had to compete with another more expensive DOE accelerator project.

"So many people were convinced that the Doubler would fail," Mravca recalled. "But Leon Lederman pulled together an incredible project team. I could hear from their voices that they would make this thing go. I was working with some of the most talented and creative people I've ever met. I saw my role as knowing the DOE system and the Department's regulations better than anyone else, so that I could help them do what they needed to do, within the system, so that the project would succeed."

It was an era Fermilab Director John Peoples remembers vividly.

"Andy had faith in us at a time when very few others did," Peoples said. "He never gave up. His role in helping us through the necessary bureaucratic processes was a major factor in Fermilab's success in creating the first superconducting synchrotron and collider in the world—and more than a decade later, it still has the highest energy."

Lundy reflected recently on the qualities that made the Fermilab-Mravca partnership so successful.

"Andy cared about the technology and the science," Lundy said. "He was never so full of himself that he wouldn't listen to expert opinion. He understood just where he could be the most valuable. He was the kind of guy you'd want to undertake a project with."

It also helped, Orr believes, that Mravca was "pure Chicago, all the way. That made it easy for us outsiders to deal with local people. Everybody at Fermilab trusted him."

They still do.

"I have a philosophy of partnership," Mravca said of his approach to the DOE-Laboratory relationship. "There has to be trust on both sides. I thought I could help build a trusting partnership by knowing the DOE requirements for procurements, personnel, budgets and safety. I believe our job at DOE is to create an environment for conducting research within the framework of the federal government system."

And the job couldn't have been better, Mravca said. "It's fantastic. I got to deal with the leaders of some of the best science in the world—dedicated, hardworking people. It was beautiful to be able to help them get science done."

As for Fermilab's view, it isn't complicated. "We were blessed to have him," Peoples said.

Village Crier Photo

"We learned to exercise judgment in how to get science done within the government system. Sometimes we could turn contracts around in two hours."

Fermilab Photo

Mravca accepts an award from then-Fermilab Director Leon Lederman, whose tenure Mravca recalls with special enthusiasm. "I've had the pleasure of working with all three Fermilab directors," Mravca said. "All three were hardworking, brilliant and dedicated. And all three were tightwads. Leon was so tight he wouldn't even rent a car. On a trip, he always tried to hitch a ride with me."

What's Beryllium ???

A beryllium window for a lithium lens.

by Sharon Butler

Beryllium is so useful a metal in industry that it can't be avoided. It's in non-sparking tools, electrical switches, computer parts, springs, diaphragms, shims and bushings.

It's also useful in physics experiments. Indeed, without it, Leon Lederman, Director Emeritus of Fermilab, and his colleagues might not have discovered the bottom quark. They needed to observe muon-antimuon pairs, and so wanted their detector to see only muons, undistracted by other particles like protons and pions. They had to choose a material to filter out the unwanted particles and let the greatest number of muons pass through, with minimum deflection of their trajectories. The best material for this was beryllium. The experimenters searched all over the country for the 12 cubic feet they needed (about two metric tons), and finally found an almost-forgotten stash in a government-surplus warehouse at Oak Ridge National Laboratory in Tennessee.

Today in experimental facilities at Fermilab, beryllium is used in beam targets, beam pipes, beam windows and support structures for detectors. Because of its ability to produce neutrons when bombarded by high-energy protons, beryllium is also used as a beam target in Fermilab's Neutron Therapy Facility. Fermilab has on-site about 4,000 pounds of metallic beryllium and 6,000 pounds of ceramic beryllia, or beryllium oxide. When it is handled, it is handled in bulk form: e.g., a beryllium part is picked up and moved to another location. Beryllium material is not cut, sanded or ground at the Laboratory, activities that might generate substantial quantities of dust.

That's an important fact, because the U.S. Department of Energy has just proposed new, more stringent rules to protect workers from exposure to beryllium. These rules are being imposed because beryllium dust can cause a serious and incurable lung ailment known as chronic beryllium disease, which results in permanent lung damage. According to a DOE press release, of 9,000 workers in the nation exposed to beryllium, 110 have developed the disease and 232 are likely to get the disease.

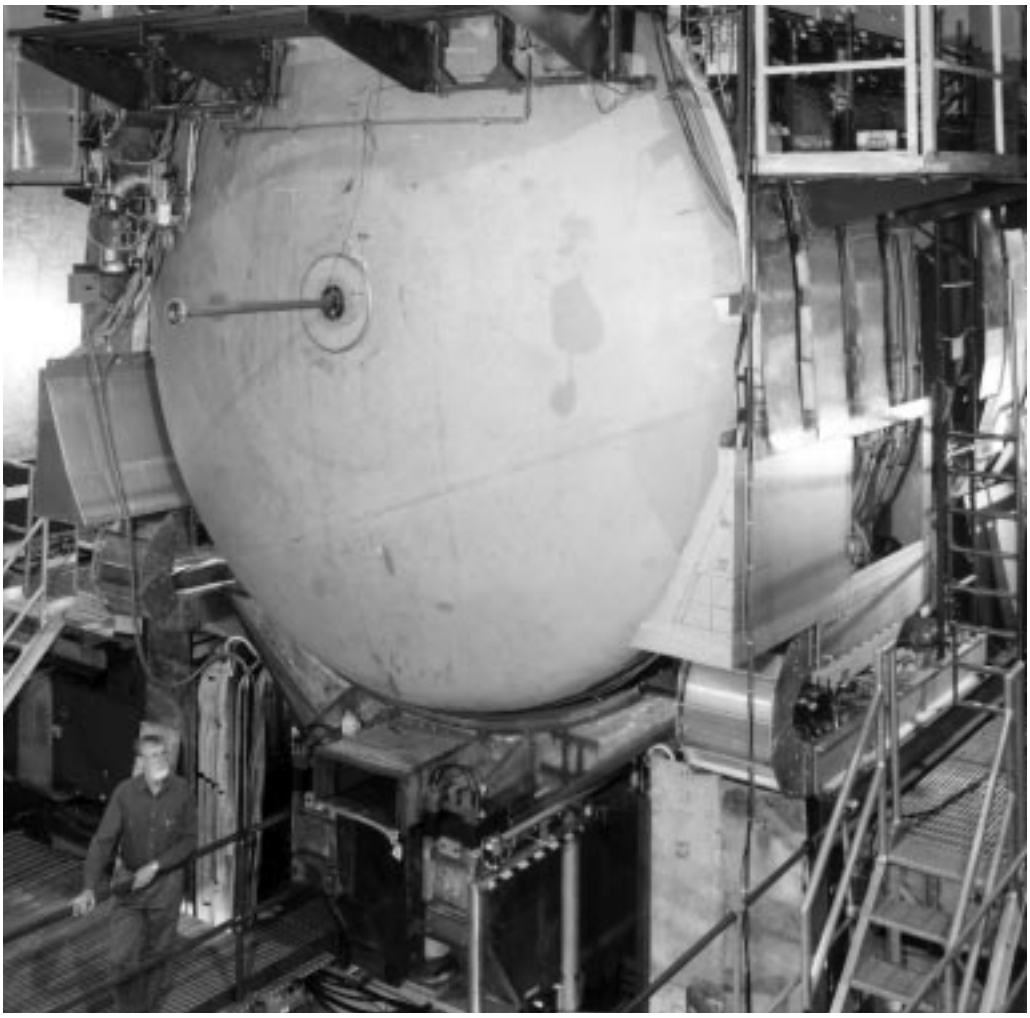
Importantly, none of these workers is from Fermilab. The Laboratory has never had a case of chronic beryllium disease; nor are there any signs that any staff here might develop the disease. The concern is primarily aimed at DOE laboratories where nuclear operations or nuclear cleanups are under way. Most of the affected individuals were machinists at defense laboratories, according to Tim Miller, Associate Head of Fermilab's Environment, Safety and Health Section.

Even so, Miller said, Fermilab insists that the element be handled with great care to protect workers from the minute amount of dust that forms as the element oxidizes from contact with the air. The Laboratory employs a variety of physical and chemical isolation techniques. For example: At present,

two workers are designated to handle beryllium—e.g., to stack the bricks of beryllium when a beryllium target or filter is needed. When these bricks are moved, the workers don disposable protective clothing (including gloves and shoe covers) and breathe through respirators to further minimize inhaling any dust. Beryllium targets and filters are isolated by placement inside steel cases or vacuum systems. Beryllium parts in beam pipes inside detectors are coated with nickel, a less toxic substance, to prevent the generation of dust and to prevent human contact. All beryllium material carries stern red warning labels.

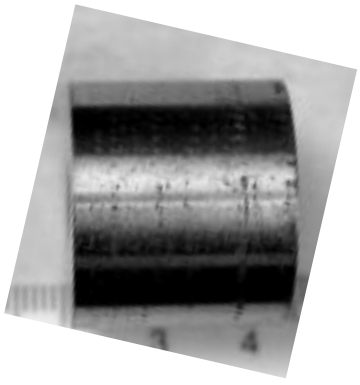
At most, 200 people at Fermilab have been exposed to beryllium over the 30 years the Laboratory has been in operation, some for a lifetime total of only a half hour, others for a maximum lifetime total of 80 hours, or two work weeks. From interviews with these individuals to ascertain the extent of their contact with beryllium even years ago, when the hazards were not as well understood, Fermilab's ES&H Section is assured that none of them has been exposed to more than two micrograms per cubic meter, the standard established by the Occupational Safety and Health Administration. That standard was set by assuming that an individual would be exposed eight hours a day, five days a week for 40 years.

"We have an excellent record of protecting our staff from the hazards of beryllium," said Director John Peoples. "The kinds of work practices that DOE has proposed are already in place here at Fermilab."



Photos by Reidar Hahn

The beam pipe shown here extending from the core of the DZero detector contains a beryllium-lined section that lies deep inside the detector.



Beryllium beam target used in the Neutron Therapy Facility.

FIVE FOR FERMILAB

American Physical Society names Foster, Jackson, Limon, Rubinstein and Yoh among 1998 Fellows.

by Mike Perricone

As any Fermilab physicist knows, the more rare events collected, the more successful the experiment.

Being named a Fellow of the American Physics Society is indeed a rare professional event, with no more than one-half of one percent of the society's 40,000 members recognized as Fellows in any year. Fermilab has supplied five of the 204 Fellows selected for 1998—qualifying as a highly successful run for the Lab.

"It is an exceptional event for five physicists from one institution to be elected to fellowship in the APS in one year," said Fermilab Director John Peoples, citing the five honorees' "very diverse and important contributions to the fields of Particle Physics and the Physics of Beams."

APS Associate Executive Officer Barrett Ripin seconded his assessment.

"Fermilab is richly endowed with physicists who are recognized as being outstanding," Ripin said.

The five APS Fellows from Fermilab for 1998, and the citations on their Fellowship Certificates, are:

- **Bill Foster**—"For contributions to development of large-scale particle physics electronics, and for a leading role in the design of the permanent magnetic-based Fermilab Antiproton Recycler Ring."
- **Gerry Jackson**—"For conceptual and technical innovations in circular colliders, leading to record-breaking luminosities in the Tevatron, and to the Recycler."
- **Peter Limon**—"For many contributions to the construction of the Tevatron, leadership in the SSC (Superconducting Super Collider) Central Design Group, and guidance of the CDF (Collider Detector at Fermilab) calorimeter upgrade."
- **Roy Rubinstein**—"For his leadership on behalf of Fermilab, U.S. physics organizations and international physics organizations to strengthen collaboration among physicists of the world."
- **John Yoh**—"For contributions to the discovery of the upsilon resonance indicating the existence of the *b* quark." (To see John Yoh's original paper on the upsilon resonance and list of collaborators, go to http://fnalpubs.fnal.gov/archive/1997/conf/Conf-97-432-E.html.)

APS, celebrating its centennial in 1999, serves as a forum for reporting and discussing new results and publishes some of the world's leading physics research journals: the *Physical Review* series, *Physical Review Letters*, and

Photo by Jenny Mullins

Roy Rubinstein

Photo by Reidar Hahn

Gerry Jackson (left), **Bill Foster**

Reviews of Modern Physics.

"I'm particularly pleased at having the recognition of my peers and colleagues for the work I've done over the years in high-energy physics," said Limon, head of the Lab's Technical Division.

Peoples noted that Limon, Foster and Jackson have made innovative contributions in both the detector and accelerator fields.

"These back-and-forth transitions are part of Fermilab's unique style," Peoples added.

In addition to their work in improving the effectiveness of Fermilab's accelerators, Foster and Jackson have been collaborators in the field of permanent magnets since the inception of the Recycler project. The Recycler, being completed as part of the Main Injector Project, is the world's largest array of permanent magnets and the only accelerator of its kind in the world.

Jackson, like all the honorees, noted the "outstanding support by everyone at the Lab."

"Unlike many other fields of physics, experimental accelerator physics is truly a team sport," Jackson explained. "Therefore, though I am honored by the award, I feel it is a recognition for everyone who worked on the Recycler and on the Tevatron luminosity upgrades."

Teamwork has been an essential element in Fermilab's growth as an international scientific community. Rubinstein, a Lab assistant director, has been the equivalent of its "foreign secretary."

"Roy Rubinstein has served as the head of the Fermilab international desk for the better part of two decades, and has made a great difference in international collaborations," Peoples said.

In addition to its homegrown scientists, Fermilab is a scientific "home away from home" for more than 800 researchers who come from more than 100 institutions in 23 foreign countries.

"The Fellowship is a recognition that physics is becoming more and more international," Rubinstein said. "That's been true of high-energy physics for many years but not necessarily for many other branches of physics until recently. It's also a recognition of the international reputation that Fermilab enjoys, both for the physics it does and for its openness to physicists from other countries."

For as long as Rubinstein has been reinforcing the value of international physics, Yoh has been involved in searches for new physics, from the bottom to the top and beyond.

"While John Yoh has made many contributions to the Laboratory, his most notable work involved his contributions to the discovery of the upsilon family, which provided the first direct evidence for the third generation of quarks," Peoples said.

A collaborator with Leon Lederman on the *b* quark's discovery in 1977, Yoh noted his continuing gratitude for the efforts of the entire group as well as the support of the Lab.

"I'm happy to have played an important role in the discovery of the upsilon/*b* quark, the first of many major discoveries at Fermilab," he added. "It is gratifying that the *b* sector represents a major focus in high-energy physics today. The critical issue in the field is comprehending masses and mixing, for which understanding CP violation and the unitarity triangle of the *b* sector are major milestones. This is the goal of machines at SLAC and in Japan and Germany, as well as a major goal for the next runs of CDF and DZero here at Fermilab."

As APS recognizes, significant people stand behind significant events.

Photo by Jenny Mullins

John Yoh

Photo by Reidar Hahn

Peter Limon

the talk of the lab

stand-down \ ‘stan(d)-daun \ *n* (ca. 1919) : a relaxation of status of a military unit or force from an alert or operational posture

safety stand-down (ca. 1998) : a stand-down of physicists, technicians and support staff for the purpose of focusing on methods of ensuring safety

---

In a memo that went out in early December, Director John Peoples announced that from December 15 through December 17, Fermilab would hold three days of safety stand-downs. Staff and contractors were all required to attend one of the day-long sessions, with morning lectures by division heads to include descriptions of near-incidents, and afternoon hazard analysis exercises to involve everyone in planning for dealing with potential hazards in a real-life task.

“I know this is not the most convenient time for you,” Peoples said on the first day of the stand-downs. “Not one of us has any time to spare. So why are we taking an entire day away from our pressing tasks and duties?”

Because, he said, “life is a precious thing….

“We are here today to make sure that every Fermilab employee, user and contractor goes home at the end of every day as healthy and whole as we started. If taking a day, or three days, away from work can save even one life or protect even one person from a life-destroying injury, it will be worth it.”

The task was to learn about “integrated safety management,” a fancy term, said Associate Director of Fermilab George Robertson, for doing work safely.

Main Injector Project Manager Steve Holmes summarized ISM as “thinking about what you’re doing before you do it, watching what you’re doing while you’re doing it; and reviewing what you’ve done after you’ve done it.”

When it comes to safety, said Lab Services Head Kay VanVreede, “you don’t want to take anything for granted…. Safety is not something that is extraneous to a job; it is an integral part.”

That lesson was repeated over and over for three days, when safety was, indeed, the talk of the Lab.

If Only I’d Looked

Old Mother Hubbard went to the cupboard to fetch her poor dog a bone.

When she got there she thought the cupboard was bare.

But wasn’t she surprised when she reached in and was bitten by the mad, hungry dog hiding in there!

—Bob Webber,
poem presented at the Stand-Down

What does a small recycling bin located in an office have in common with a pair of magnets weighing a combined 183 tons?

Both have been the sources of accidents at Fermilab. Ironically, the small recycling bin—not the gargantuan magnets—caused

an injury resulting in lost work time. A worker in the Lab's Business Services Section tripped over the recycling bin, suffering a broken arm in the fall.

Business Services has made a dramatic turnaround in its lost-work-day case rate: only three in 1998, down from 40 in 1997 and 299 in 1996—"a real eye-opener," said Section Head Jim Finks.

Business Services handles the payroll, accounting, legal matters, records management and mailroom operations, but also oversees all procurement, receiving, shipping and warehousing for the Lab's materials and components, as well as property inventory, a scrap metal operation and maintenance of the Lab's 225 vehicles. "Business Services is a little more interesting than it sounds," Finks said.

The turnaround in safety statistics has resulted from monthly "walkthroughs" of all areas of the section, and what Finks termed an "open door policy."

"If there's a question about safety, I want to hear about it," he said. "Nothing is too big or too small to discuss. There are absolutely no dumb safety questions."

The magnets in question (one weighing 61 tons, the other 122 tons) were located close together, and somehow had been installed the wrong way; their polarities were lined up to attract each other.

"Which they did, with a pronounced thud and about 20 tons of force," said Particle Physics Division Deputy Head Stephen Pordes. "It was the most impressive unplanned motion of large objects I've ever witnessed."

There were no injuries. The installers hadn't identified the possible hazard of the magnets attracting each other, and hadn't verified the line-up of polarities. After the incident, the division took corrective action: it developed devices to detect polarity quickly and easily. One more lesson: talk. Other installers had encountered and solved a similar problem in another area of the Lab—but hadn't communicated their experience.

The recitation of accidents and close-calls left deep impressions in the three days of safety stand-downs. A hay-loading contraption for feeding Fermilab's buffalo herd once slipped its moorings with someone standing on it. Workers once drilled through concrete, straight into an electrical conduit that, by luck, was not energized. A technician put out a hand to steady himself on the edge of a cable tray, and grabbed the bare end of an abandoned, but live, 120-volt cable. Passing employees gave a mysteriously buzzing power supply a hearty slap, and sparks flew. A heavy granite table escaped while en route to a new locale, gouging serious chips out of pressurized bottles of helium.

The audience gave a collective gasp at a color photo of the damaged gas vessels and the thought of what might have happened if the gouges had gone a bit deeper.

"The incidents were sobering," said Roger Slisz, of the Facilities Engineering Services Section. "Usually, we hide these things like dirty laundry. But hearing about them made you think hard about safety."

"The first training method we're using today is repetition," said Bill Shull, of FESS. And it was.

At every afternoon hazard analysis workshop, participants learned that planning a job—whether designing a circuit board,

the talk of the lab

wiring a power supply or painting a hallway—includes planning for handling potential hazards. Written plans are sometimes required: for each task to be performed, the anticipated hazards and the precautionary measures for dealing with each of those hazards have to be enumerated.

Another lesson drummed in: The first preference for dealing with any hazard under ISM is to eliminate it; the next is to control it, if it can't be eliminated; and the third preference, if it can't be eliminated or controlled, is to protect the workers involved.

The ways and means are not always obvious. Protecting workers against being pinned along a cabinet wall by the robotic arms recently acquired by the Computing Division seemed to one employee near-impossible. "You'd have to dress like a knight-in-armor to protect yourself from that thing," said David Sachs, of the Computing Division, in a hazard analysis class.

But special training is required of all technicians who deal with the robot. And failsafe lock out-tag out procedures ensure that the power is off, and stays off, before anyone can enter the cabinet where the robot resides.

Ray Yarema and Mark Larwill, of the Electrical Support Group of the Particle Physics Division's Engineering and Technical Teams, presided over two afternoon exercises in electronic assembly safety that were lively, intense and could easily have extended well beyond their three-hour allotment.

"I never got to use my planned wake-up device," Yarema said, closing the session.

He stamped his foot on a small, well-hidden air pillow that burst with a satisfyingly startling "POP!"

The session was over, but the discussions on the safety plans continued down the corridor and into the elevators.

Peter Limon, head of the Technical Division, said he's never experienced a serious accident, but…

"Once in a while, I think about something I did 20 years ago, and I start to sweat," Limon said. "When I think about what I did, I realize I wasn't thinking about what I was doing."

"Ultimately, all accidents are expressions of the laws of physics," said Fermilab Director John Peoples. "Fermilab is a physics laboratory. Therefore, we should bring special expertise to addressing and avoiding accidents."

— **Written by Sharon Butler, Judy Jackson and Mike Perricone**

LETTER TO THE EDITOR

I am a lawyer and not a physicist. I live and work in Minnesota and not at Fermilab. I am interested, however, in high energy particle physics. I have toured Fermilab. My close friend Noah Wallace (who is a physicist and does work at Fermilab) has undertaken the herculean task of trying to teach me some of the basic laws of physics. He has found this to be tough sledding.

However, Noah has taught me that nothing can go faster than the speed of light. Imagine my surprise then when I opened my latest issue of *Ferminews* and read the article about the antiproton recycler. On page 2, and if my calculations are correct, the recycler will shoot the antiprotons through the beam tube faster than the speed of light.

The article states that the recycler is 1.99 miles around and that the beam will complete "about 100,000 revolutions per second." According to my hand-held Canon calculator, that works out to a speed of approximately 199,000 miles per second, faster than the speed of light.

I know Fermilab routinely finds out interesting stuff, but to discover something that goes faster than the speed of light is pretty big. I await follow-up articles to see how this can be so. In the meantime, the Theory of Relativity may need to be reexamined. But do not count on me for that.

Yours (tongue in cheek) truly,
Roger Junnila

You caught us with our approximations down. We should have said "almost 100,000 revolutions per second." You do raise an interesting point about the speed of light, however. The ultimate speed limit (so far) is the speed of light in a vacuum. In other materials, other particles can and do travel faster than light, a principle exploited by recording the tracings of Cerenkov radiation in the huge liquid detectors used in such areas as neutrino experiments. Cerenkov radiation is light emitted by a high speed charged particle when the particle passes through a transparent, nonconducting material at a speed greater than the speed of light in that material—light's equivalent of a sonic boom. *—Asst. Editor*

MILESTONES

RETIRED

Thomas Droege, I.D. #2157, on December 11, from the PPD/Engineering & Tech. Teams.

Laura Thompson, I.D. #5967, on January 5, from the BS/MA/SU/Vehicle Maintenance.

Chez Léon MENU

Lunch served from 11:30 a.m. to 1 p.m.
$8/person

Dinner served at 7 p.m.
$20/person

For reservations, call x4512
Cakes for Special Occasions
Dietary Restrictions
Contact Tita, x3524
http://www.fnal.gov/faw/events/menus.html

Lunch
Wednesday, January 13

Prosciutto, Spinach, Red Pepper and 3 Cheese Calzone
Red and White Cabbage and Carrots
Coffee Flan

Dinner
Thursday, January 14

Tuscan Bean Soup
Seafood and Lemon Risotto Shaved Fennel, Pear and Oil Cured Olive Salad
Espresso Walnut Torte with Whipped Mocha Cream

Lunch
Wednesday, January 20

Chili and Coriander Chicken with Tamarind Sauce
Basmatic Rice
Chick Peas and Peas with Tomatoes
Yogurt Cake with Orange Liquor

Dinner
Thursday, January 21

Spicy Stuffed Collard Greens
Roasted Pork Tenderloin with Rosemary Mustard and Buttermilk Marinade
Vegetable of the Season
Chocolate Pecan Pie

FERMI NEWS
FERMILAB
A U.S. Department of Energy Laboratory

Editor: Sharon Butler
Assistant Editor: Mike Perricone
Design: Performance Graphics

Ferminews is published by Fermilab's Office of Public Affairs.

The deadline for the Friday, January 22, 1999, issue is Tuesday, January 12, 1999. Please send classified advertisements and story ideas by mail to the Public Affairs Office MS 206, Fermilab, P.O. Box 500, Batavia, IL 60510, or by e-mail to ferminews@fnal.gov. Letters from readers are welcome. Please include your name and daytime phone number.

Fermilab is operated by Universities Research Association, Inc., under contract with the U.S. Department of Energy.

CLASSIFIEDS

FOR SALE

- '90 Accord EX. Teal with tan interior, excellent condition. Automatic transmission, power everything, AC, moonroof. 137,000 miles. $4500 obo. Andreas, x3753 or ask@fnal.gov
- '87 Dodge Caravan, $800 obo. Single sized waterbed mattress, liner & heater, $35. Call x5427.
- Cross country skis (190), poles (130), boots (40) all for $50; Wax Master 9″ random orbit waxer/polisher, $35; vacuum cleaner canister, $25; Software: Quicken, Word Perfect, Excel. Call Rich x3880, (630)690-1691.
- Software (shareware & boxed titles) want to sell in bulk call for details. Ski's 195 atomic arc, bindings, poles, boots & bag, $190 obo; king size waterbed frame & headboard needs mattress, $75 obo; wood lathe included: chisels, cabinet w/drawers $250; dive equipment, parkway bc vest $85, US divers wet suit, $50; Elvis collector plates (4) $25 ea; cajun wood/charcoal smoker $15; 2 old style military cots $15 ea; complete set of b&w darkroom equipment (w/enlarger) great starter kit, $30 obo. Call Terry x4572 or e-mail skweres@fnal.gov.

FOR RENT

- Large bedroom plus living room in quiet residential Naperville, 20 min from lab. One car garage, 1 private bath, laundry & kitchen privileges, available now, $395/mo. Call (630) 983-3575.

CALENDAR

Web site for Fermilab events: http://www.fnal.gov/faw/events.html

JAN 8

Fermilab International Film Society presents: *In the Company of Men,* dir: Neil LaBute (Canada, 1997, 93 mins.). Film at 8 p.m. in Ramsey Auditorium, Wilson Hall, $4. (630) 840-8000.

JAN 10

Barn dance in the Kuhn Village Barn, 7–10 p.m. All dances are taught. People of all ages & experience levels welcome. Admission is $5, kids under 12 free (12-18, $2). Sponsored by the Fermilab Folk Club. Contact Lynn Garren, x2061, or Dave Harding, x2971.

JAN 11

Wellness Works Brown Bag Seminar presents: *Stress Management*, 12-1 p.m., 1 West. The presenters will be Sue Perry & Betty Sloan of Barbara Kennedy & Associates, Counseling & Psychotherapy Group, Naperville. For more information, call Bernie, x3591.

JAN 12

Academic lectures on CP violation: *Hyper CP*, Cat James, Curia II at 11 a.m.

JAN 16

Fermilab Art Series Presents: *John Astin: Once upon a Midnight*, $20. Performance begins at 8 p.m., Ramsey Auditorium, Wilson Hall. A pre-performance lecture by Joel Ruich begins at 6:45 in 1 West, Wilson Hall.

SOLD OUT

This lecture is free with purchase of performance tickets. (630) 840-ARTS.

JAN 17

Barn dance in the Kuhn Village Barn, 2–5 p.m. All dances are taught. People of all ages & experience levels welcome. Admission is $5; children under 12 free (12-18, $2). Sponsored by the Fermilab Folk Club. Contact Lynn Garren, x2061, or Dave Harding, x2971.

ONGOING

NALWO coffee, Thursdays, 10 a.m. in the Users' Center, call Selitha Raja, (630) 305–7769. In the barn, international folk dancing, Thursdays, 7:30–10 p.m., call Mady, (630) 584–0825; Scottish country dancing, Tuesdays, 7–9:30 p.m., call Doug, x8194. English classes on Tuesdays at the Users' Center. Beginners from 9–10 a.m.; intermediate students, 10–11 a.m. Fee of $4 per morning. Students welcome to attend both classes. Lessons taught by Rose Moore, (630) 208-9309.

☆ U.S. GPO **1999--746-048 / 5**

F E R M I L A B
A U.S. Department of Energy Laboratory

Office of Public Affairs
P.O. Box 500, Batavia, IL 60510

Bulk Rate
U.S. Postage
PAID
Bartlett, IL
Permit No. 146