

SPECIAL
EDITION

FermiNews

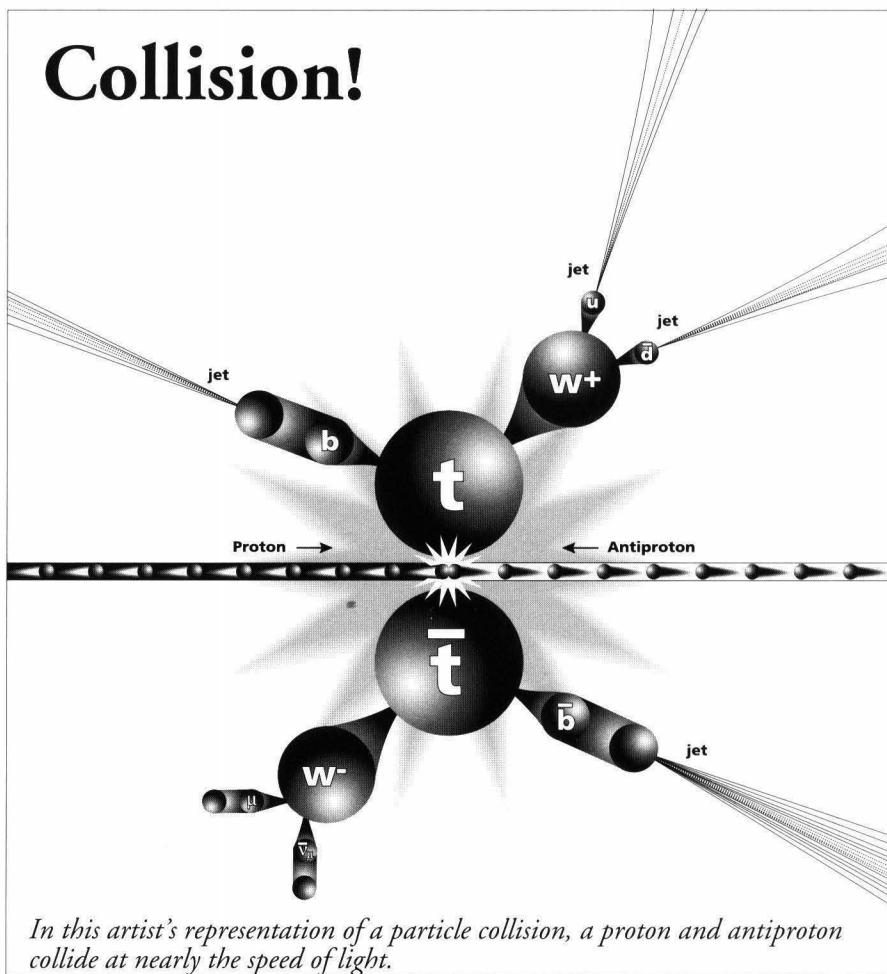
The Newsletter of the Fermi National Accelerator Laboratory

IS IT THE TOP QUARK? YES!!!

Physicists at Fermilab today announced the discovery of a subatomic particle known as the top quark, the last undiscovered quark of the six predicted to exist by current scientific theory. Scientists worldwide had sought the top quark since the discovery of the bottom quark at Fermilab in 1977.

Two research papers, submitted simultaneously on Friday, February 24, to *Physical Review Letters* by the CDF and DZero experiment collaborations respectively, describe the observation of top quarks produced in high-energy collisions between protons and antiprotons, their antimatter counterparts, at Fermilab's Tevatron, the world's highest energy particle accelerator. The collaborations, each with about 450 members, will present their results at seminars held at Fermilab today.

"Last April, CDF announced the first direct experimental evidence for the top quark," said WILLIAM CARITHERS, JR., spokesperson for the CDF experiment, "but at that time



In this artist's representation of a particle collision, a proton and antiproton collide at nearly the speed of light.

Events of the Day

Thursday, March 2, 1995 • Volume 18, Number 4



CDF Seminar 1:30 p.m., Ramsey Auditorium

DZero Seminar 2:30 p.m., Ramsey Auditorium

Media Opportunity, pass required 4:00 p.m., 1 West Conference Room

The CDF & DZero preprints, the top quark press release and background information is available via WWW on the Fermilab home page. The URL is <http://www.fnal.gov/> Paper copies of the preprints can be obtained from the Publications Office, WH15SW.

we stopped short of claiming a discovery. Now, the analysis of about three times as much data confirms our previous evidence and establishes the discovery of the top quark."

The DZero collaboration has discovered the top quark in an independent investigation. "The DZero observation

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TOP QUARK

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of the top quark depends primarily on the number of events we have seen but also on their characteristics," said PAUL GRANNIS, DZero spokesman. "Last year, we did not have enough events to make a statement about the top quark's existence, but now the signal is clear."

Both collaborations have strong inter-

national participation. Experimenters from Brazil, Canada, Colombia, France, India, Italy, Japan, Korea, Mexico, Poland, Russia and Taiwan joined U.S. scientists in the search for the top quark.

"The discovery of the top quark is a great achievement for the collaborations," said Fermilab Director John Peoples, "and also for the men and

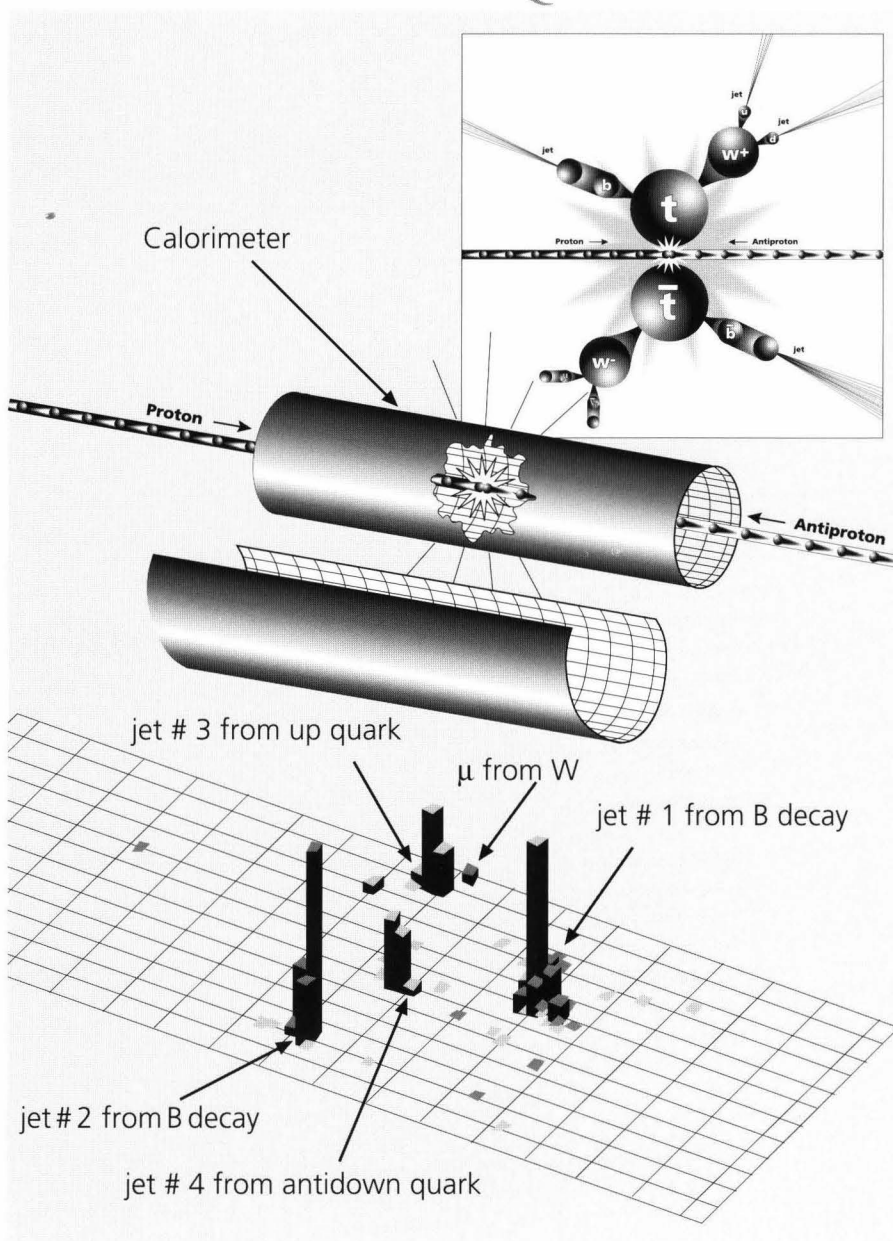
women of Fermilab who imagined, then built, and now operate the Tevatron accelerator. We have much to learn about the top quark and the nature of matter in the decade ahead. We look forward to the next phase of research with this extraordinary accelerator, the most powerful tool on earth for precisely characterizing the deep substructure of matter." ■

HOW DO WE KNOW IT'S A TOP QUARK?

Physicists recognize the particles produced in proton-antiproton collisions by their electronic signatures, shown graphically by computers. In the "lego-plot" below, the height of each lego tower shows the amount of energy detected in each cell of a detector's calorimeter after a particle collision like the one illustrated.

How can we recognize a top quark's electronic signature? Top quarks exist for such a short time that we don't actually find their signatures, but instead those of their known decay products. Here, the lego plot shows one characteristic signature pattern—called a "lepton plus jet event"—that we expect to see in a collision that produces a top-antitop quark pair. The top quarks instantly decay into two W particles and two b quarks. One W in turn decays into a muon and a neutrino, the other into up and down quarks. The up and down immediately decay into jets of particles. The b quarks travel a little way before they decay into jets.

The results of this collision are a muon, a neutrino and four jets of particles. The lego plot identifies the muon and the four jets. The neutrino leaves no tracks; we infer its existence from missing energy in the collision results.



TRAC TEACHER BRINGS HIGH-ENERGY PHYSICS TO CLASSROOM

Jeff Rylander's physics classroom at Main East High School in Park Ridge, Illinois looks like many laboratory classrooms in the U.S.—tables and chairs are scattered about along with some lab equipment and a computer or two. But if you look closer in his room, you can see something not many other high schools have. Adjacent to a personal computer is a 4'x3'x1' box, or "coffin," as Jeff calls it.

This "coffin" is not for bidding laboratory mice adieu, rather it's used for a sophisticated experiment to measure the lifetime of a muon, a charged particle produced when cosmic rays collide with atoms in the earth's upper atmosphere. Modeled after similar equipment at Fermilab, this box will offer Jeff and his students a unique opportunity—an opportunity to explore high-energy physics much in the same way as it is done at Fermilab and other high-energy physics labs.

Jeff, a junior honors and introduction to physics teacher, built this muon detector while at Fermilab last summer as part of the Education Office's Teacher Research Associates Program (TRAC). He received help from DANE SKOW of the Physics Section as his program mentor and KAREN KEPHART, also of the Physics Section.

As part of the TRAC program, participating teachers are given a stipend to purchase equipment to help them bring their "research experience" back to their schools. After

some consideration, Jeff and Dane decided on building a muon experiment. They modeled it after a similar lab

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Jeff Rylander (lower l) with five students from his junior honors physics class and Dane Skow (lower r) in front of their muon detector. Jeff brought his students to the Lab in December for the test run of the equipment. "It was exciting for the students to see an experiment take its first data," said Jeff.

BE SAFE THIS SPRING: TORNADO AWARENESS TIPS

The week of March 6, 1995 has been designated as Tornado Preparedness Week by the Illinois Emergency Management Agency. As we approach the tornado season, it is important to become familiar with the unique character and weather terms that will be used throughout the season.

A tornado is a violent storm with whirling winds of up to 300 miles per hour. It appears as a rotating, funnel-shaped cloud, from gray to black in color, that extends toward the ground from the base of a thunderstorm. A tornado spins like a top and may sound like a

roaring airplane or train. These short-lived storms are the most violent of all atmospheric phenomena, and over a small area, the most destructive.

According to the National Oceanic and Atmospheric Administration (NOAA), the peak month for tornado activity in Illinois is April. However, tornadoes have occurred as late as November.

The National Weather Service issues two types of tornado-related alarms, a tornado watch and a tornado warning. For your safety, familiarize yourself

with both alarms.

A tornado WATCH means that conditions are favorable for tornadoes to develop. Listen to local radio, television or NOAA weather radio. Be alert for changes in the weather and be prepared to move to a place of safety quickly.

A tornado WARNING means that a tornado has been sighted and confirmed in the area. When a warning is issued, take cover immediately in a designated shelter. Stay away from outside walls and windows.



NEWS FROM THE WASTE MINIMIZATION SUBCOMMITTEE

REMINDER
Please don't mix items in recyclable bins. When

recyclables are mixed, the amount paid to Fermilab is reduced. Many times when large amounts of items are mixed, all items end up in the garbage, since sorting recyclables is too time consuming. Keep non-recyclable items such as three ring binders, transparencies and computer reel tape holders out of the recycling bins. Recently the Cafeteria has switched back to paper plates. Paper plates are not recyclable and should NOT be placed in the Styrofoam bins. Styrofoam dishes, plastic cups (#6) and plastic silverware can still be placed in the Styrofoam bins. Be particularly careful not to mix non-recyclables (i.e.

paper plates) with Styrofoam. Our vendor will not accept non-recyclables with the Styrofoam.

NEW RECYCLING IDEAS

Instead of throwing away those obsolete reports, they can be recycled. The "spiral spines" can be pulled off and sent to Duplicating where they are put back in stock for new reports. Also, the paper can be separated and recycled in the normal manner.

One area where we hope to make progress this year is in the procurement of recyclable as well as recycled products. Recyclable materials are those materials that can be used to make another product. The amount of this recyclable material is listed as "post

consumer." Recycled products contain some amount of post consumer materials. We hope to pursue purchasing some of these products. When considering these types of items several factors must be considered, such as appearance, interchange ability and quality. Many high quality recycled products are now available. Please consider both recycled and recyclable products when making a purchase request.

Remember, all it takes for you to set up recycling in your area is a few bins from the Stockroom and a few volunteers to take the recyclables to the central collection area. If you need help or advice in setting up a local collection area, please call Kevin at x2248 or Kay at x2279.

SAFETY EYE WEAR VENDOR CHANGED

In March, the current safety eye wear contract with Rosin Optical expires and a new contract begins with Cabot Safety Corp. No new orders should be placed with Rosin Optical after March 10, 1995.

The general procedures for obtaining eye wear will remain the same. Employees still need to fill out a prescription safety eye wear request form and have it signed by their supervisor. If glass, photochromic or transition lenses are requested, the signature approval of the division/section safety office and the head of the ES&H Section is required. Employees must also make sure that they have a prescription that is no more than 18 months old. An order for prescription safety eye wear can then be placed with the on-site, vendor-provided optician or at one of the numerous vendor-coordinated, off-site commercial eye wear facilities. The Lab pays for the cost of lenses and a base frame. This coverage is limited

to the optically- and occupationally-required features of the eye wear. Costs for eye exams, fashion frames or other tints/coatings are borne by the employee. Most eye wear should continue to be ready for pickup one week after ordering.

However, there are a few changes:

- A new prescription safety eye wear request form will be required. The old yellow form with the old vendor name and purchase order number will not be accepted. New forms can be obtained from your division/section safety office or from the ES&H Section, WH7E, in the room just to the west of the elevators.
- The cost carried by the employee must be paid in cash or Visa/Mastercard. Personal checks will not be accepted.
- The hours will be expanded. The day for seeing the on-site optician will still be Wednesday, but the hours will be from 10 a.m. to 2 p.m. The on-site

location will remain the same: Wilson Hall 7E.

- The list of off-site locations will change. This expanded list will be available from the ES&H Section the week of March 13.
- Since eye wear will be manufactured in Indiana and sent to Fermilab by commercial carrier, you may experience a slight increase in turnaround time.
- A "hotline" number with a recorded message is also planned so employees can call in to find out if their prescription safety eye wear is ready for pickup at the next available Cabot Safety visit to the Lab.

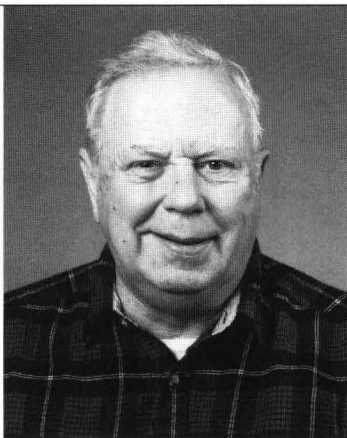
We anticipate the transition to the new vendor to go smoothly. However, if you experience any problems or complaints, please send a message to JENNY RAPOVICH (E-mail FNALV::RAPOVICH).

People Events

JOHN MORRISON TO RETIRE

JOHN MORRISON of the Research Division/Mechanical Support group is retiring March 7, 1995 after 12 years of service to Fermilab. John joined the Lab in April 1983. He says good-bye March 7. During his career at the Lab, John worked on DZero and the SSC/SDC project.

After he retires, he and his wife plan to move to Texas. "I enjoyed working here," said John. "I sure will miss the people."



HOUSING DEADLINE

The deadline for receipt of reservations for summer on-site housing is tomorrow, March 3, 1995. For further infor-

mation, please contact the Housing Office at x3777, FNALV::HOUSING or fax x2823.



A scene from the Acting Company's production of *Othello*.

ARTS SERIES PRESENTS

FERMILAB'S QUARTET IN RESIDENCE, THE ARIANNA QUARTET, THIRD CONCERT IN SERIES

The Fermilab Arts Series, in conjunction with the Northern Illinois School of Music, is proud to present the third concert by its quartet in residence: the Arianna Quartet. The quartet will present its Sunday afternoon concert on March 5, 1995 in Ramsey Auditorium beginning at 2 p.m. The final concert of the season is April 30, 1995. No advance ticket purchase is necessary. Tickets will be available at the door 45 minutes prior to each performance for a price of \$5.

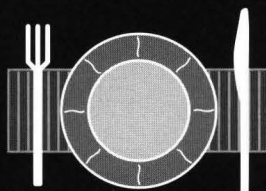
The program will include Beethoven's String Quartet, Op. 18, No. 1, Mendelssohn's String Quartet, Op. 13 and a short piece by Turina.

The Arianna Quartet are winners of the 1994 Fischhoff, Coleman and Carmel Competitions. Formed in 1992, the Quartet spent a year in residence at Kent State University. They are currently studying with the internationally renowned Vermeer Quartet as resident graduate string quartet at Northern Illinois University's School

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Chez Léon Menu

Lunch (Wed) \$8.00 • Dinner (Thurs) \$20.00
Reservations: x4512



Thursday, March 2 • *Artichoke, black olive and pimiento salad; grilled veal chop w/capers and lemon; risotto primavera; espresso parfait*

Wednesday, March 8 • *Chicken pitas, garden salad, pineapple flan*

Thursday, March 9 • *Eggplant, pepper and tomato salad; Chilean sea bass w/ lemon butter sauce; potato Dauphinas; vegetable of the season; lemon rollcake*

Wednesday, March 15 • *Cheese fondue, spring salad, fruit ambrosia*

Thursday, March 16 • *Booked*

CHECKMATE!

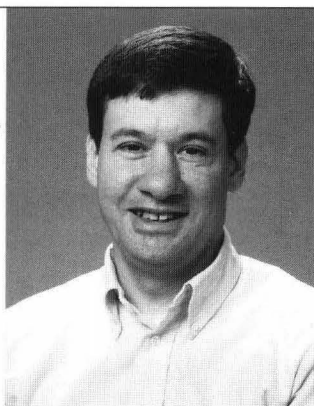
He might not be the next Bobby Fischer, but in the eyes of eight middle school students, LENNY SPIEGEL of the Research Division is somewhat of a king in the chess game.

This past fall, Lenny took on four pairs of students from St. Charles' Haines Middle School chess club in simultaneous chess matches. Despite facing some tough competition, Lenny pulled out victories in each game.

"As simultaneous exhibitions go, four boards is a small number," said Lenny. But "there were not enough chess sets to play more games."

Lenny, a chess player since the age of seven, was invited to play at a meeting of the chess club by his wife, Sandy, the group's organizer and a social worker at Haines. "I think chess can be a useful tool for developing analytic thinking," noted Lenny. "My wife tells me that

the sporting element of the game appeals to students who would otherwise tune out conventional instruction."



Lenny learned his chess skills from his father, further developing them as a member of his high school's chess team. As a Fermilab physicist, he no longer has time to play in tournaments but he still participates as a member of the Fermilab chess team. The team participates in matches within the Chicago Industrial Chess League and a few years ago placed second behind Argonne National Laboratory in the Chicago-area championship.

ARTS SERIES

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of Music. They recently won top honors at all three of last year's national competitions on three consecutive weekends: the Fischhoff National Chamber Music Competition; the Coleman Competition in Pasadena; and the Carmel Chamber Music Competition in Carmel, California. Earlier this year they were one of six internationally selected ensembles to participate in the first Isaac Stern Chamber Music Master Class at Carnegie Hall where their coaches included Mr. Stern, Arnold Steinhardt, Michael Tree, Timothy Eddy and Ralph Kirschbaum. In addition, the Arianna Quartet spent the summer working with Martha Katz and Lorand Fenyves at the Banff Academy of Chamber Music.

Don't miss Othello presented by the Acting Company, Saturday, March 4, 1995 in Ramsey Auditorium. Considered to be one of Shakespeare's greatest plays, Othello is a tragedy built of jealousy. The intimate story follows the Moor, Othello, a great general in the service of the Venetian republic and Iago, Othello's ensign, who seems to be an honest soldier but who is, in truth, a malevolent man. States Director Penny Metropulos, "Although there is no real metaphysical or political world picture in the play, to me Othello reflects the most important part of the world: human relations, our complex responses to one another. There have been critics who have complained that Othello is a 'tragedy without meaning.' How can that be true, particularly today, when our society is desperately seeking to understand the apparent meaningless cruelty that is all around us?"

The Acting Company is unlike any other professional theater in America. They are devoted to the art of acting and to producing that art for a national

FERMILAB LECTURE SERIES PRESENTS

Buckyballs and Nanotechnology
Dr. Richard Smalley,
Rice University

A recent discovery in the field of chemistry has virtually added a whole new dimension to the way one looks at carbon. Dr. Richard Smalley of Rice University has been instrumental in this revolutionary find and will discuss Buckyballs at his lecture in Ramsey Auditorium on Friday, March 10, 1995 at 8 p.m.

Graphite sheets, composed of carbon in a hexagonal lattice, provide the only known example where atoms of a single element combine to produce a chemi-

cally passive 2-dimensional surface. With the incorporation of pentagons, this passive surface may be given a positive curvature. With 12 pentagons, that surface closes to form a fullerene which may be either spherical or tubular. Using heptagons in the hexagonal lattice, it is possible to generate a negative curvature. In all cases, the carbon surface is extremely stable. With appropriate chemical substitution inside and/or outside, these carbon-based nanostructures offer an array of rationally designed new materials including semiconductors, superconductors, nanowires and catalysts.

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NALREC NEWS

Get a little luck of the Irish at the next Nalrec party on St. Patrick's Day, Friday, March 17, 1995 from 5:15 to 9:15 p.m. in the Village Barn. Homer C will D.J., and good, old-fashioned Irish fare of Reuben sandwiches and potato soup will be served for \$1.50. There will also be door prizes and refreshment specials. Look for more information on Nalrec posters scattered throughout the site. Please make plans to attend our first party of the year. Hope to see you there—Your Nalrec board: Nancy, JoAnn, Ed, Dominick, Alan and Linda.

MOVIE SCHEDULE

The Fermilab International Film Society presents movies from all over the world. Movies are shown at 8 p.m. Fridays in Ramsey Auditorium. Admission is \$3 for adults, \$.50 for children 12 and under.

■ March 10: *High Heels*

Racy, comedy-drama. A young woman becomes closer to her famous diva mother when their mutual lover is murdered and they're both suspected of the crime. Pedro Almodovar, director, Spain, 1991, 115 minutes.

Harper's Index

Percentage of all domestic mail sent through the U.S. Postal Service that consists of personal letters: **4.5**

Number of fan letters Mr. Rogers answers personally each year: **5,000**

TRAC TEACHER

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experiment Dane had seen in graduate school that measured the muon lifetime with a personal computer and a single scintillator counter.

Jeff and Dane worked with many people to develop their muon detector. Besides help from Karen Kephart in assembling the equipment, STEN HANSEN of the Physics Sections was also instrumental in designing the custom electronics interface module that connects the detector and the computer. "I think we all enjoyed the experience of pulling the experiment together," said Dane.

With all that is involved in building a detector, Jeff now has a new outlook on physics. "I'm beginning to understand

why high-energy physics experiments don't just take a week to build," said Jeff.

Jeff and his students are in the testing stage with their experiment. "Now that the detector is built, we are in the process of interfacing it with a computer that will process the data," noted Jeff. "My goal is to be up and running by April or May. I want the students to be running the experiment when we cover modern physics in class."

Jeff added that his students are very excited about the experiment. "They are ready to get it working and get some real data. They have been involved in all stages of the experiment. I have some kids working in the computer end of it

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10-Year Service Awards

Associate Director Bruce Chrisman presented 10-year service awards to 34 Fermilab employees at a luncheon January 13, 1995 at Chez Léon. Pictured are: (Row 1, l to r) Glenda Boston, Harvey Bruch, Phyllis Deering, John Buckley, Robin Denham and Cindy Love. (Row 2, l to r) Cyndi Rathbun, Scott Lockwood, Tim Hamerla, Rose Gatzke, Ted Zmuda and David Ifversen. (Row 3, l to r) Nancy Hughart, Ron Kellett, Brian LaVoy, Jim Holub, Rick Ford and Michael McGee. (Row 4, l to r) Richard Treece, Don Flynn, Lewis K. Morris, Chuck Federowicz and Directorate Representative Bruce Chrisman. (Not pictured) Gerald Annala, Robert Biester, Frederick Borcharding, James E. Finks III, G. William Foster, Thomas Lackowski, R. Daniel Munger, Charles Paul, Raymond Tomlin, Albert Wagner, Rose Warner and James Welch.

TRAC TEACHER

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and then some in the electronics part.”

To conduct the experiment, the students will time the interval between two important flashes of light. Since muons are electrically charged, they create a flash of light in the detector as they travel through it. Muons are not stable and eventually decay into an electron and two neutrinos. This electron is also charged and creates a pulse of light as it traverses the detector. By timing the interval between these two flashes of light, the students will see a distribution from which they can calculate the lifetime of a muon.

“This experiment includes all the elements of a real high-energy physics experiment,” said Dane. “There is understanding the detector, setting up the equipment and understanding the backgrounds. After all, most of the muons go right through the plastic (detector) and don’t stop. The experiment also allows for many adaptations and revisions to investigate questions raised by the first experiment.”

Jeff said this experience at Fermilab was very helpful for him as a teacher. “The TRAC program is shaped the way I want to run my classroom. Rather than lecturing, I can say to my students, ‘Here’s a lab—discover something. You are the physicists. I want you to discover the physics.’” ■

FermiNews

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Fermi National Accelerator Laboratory*

FermiNews is published by the Fermilab Publications Office

MS 107, PO Box 500 Batavia, IL 60510 • 708-840-3278 • FNAL::TECHPUBS

Fermilab is operated by Universities Research Association, Inc.

under contract with the U.S. Department of Energy

CLASSIFIEDS

■ VEHICLES

1994 Chevy S-10 Blazer, garnet over silver, 4D, 4WD, loaded, low mileage, \$21,500. Call Jim at x3371 or Jenny at x3644 days or 815-729-9072 evenings.

1986 Chevy Nova CL, 4 door, AC, auto, stereo, rear defogger, custom interior, tilt wheel, no rust, \$2,600. Call Sue Hardy at x3762 or 708-377-2526.

■ MISCELLANEOUS

Exercise rowing machine, Tunturi mod. R202, new \$175, \$65 o.b.o.

Call Bob at x2817 or 708-904-0035.

Golf clubs: metal driver w/true temper dynamic gold shaft, \$30; metal 3 wood w/graphite shaft, \$40; metal 5 wood w/graphite shaft, \$40. All are matching heads w/regular flex shafts, very good condition. Call Jack at x2812.

■ REAL ESTATE

Two bedroom house for sale, nice N.E. Aurora neighborhood, new carpet, paint, large fenced-in yard, 1.5 car garage, full basement, \$72K. Call Mike at x4596.

LECTURE SERIES

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Dr. Smalley is currently a professor of Physics and the Gene & Norman Hackerman Professor of Chemistry at Rice University. He is the recipient of numerous awards including the Madison Marshall Award (1995) and the Harrison Howe Award (1994). He received his bachelor of arts degree at the University of Michigan, and his masters and Ph.D. from Princeton University. For reservations, call xARTS

ARTS SERIES

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audience. Their mission is to develop America’s most gifted young actors by touring them in an exciting repertory of classic and contemporary plays. Since its founding in 1972 by Margot Harley and John Houseman, the Company has helped further the careers of almost 200 actors and has played before almost 2,000,000 people. Othello tickets are \$15. Call xARTS for reservations.



The deadline for the
Fri., March 17, 1995
issue is WED., MAR. 8.
Please send your article
submissions or ideas to
the Publications Office.

