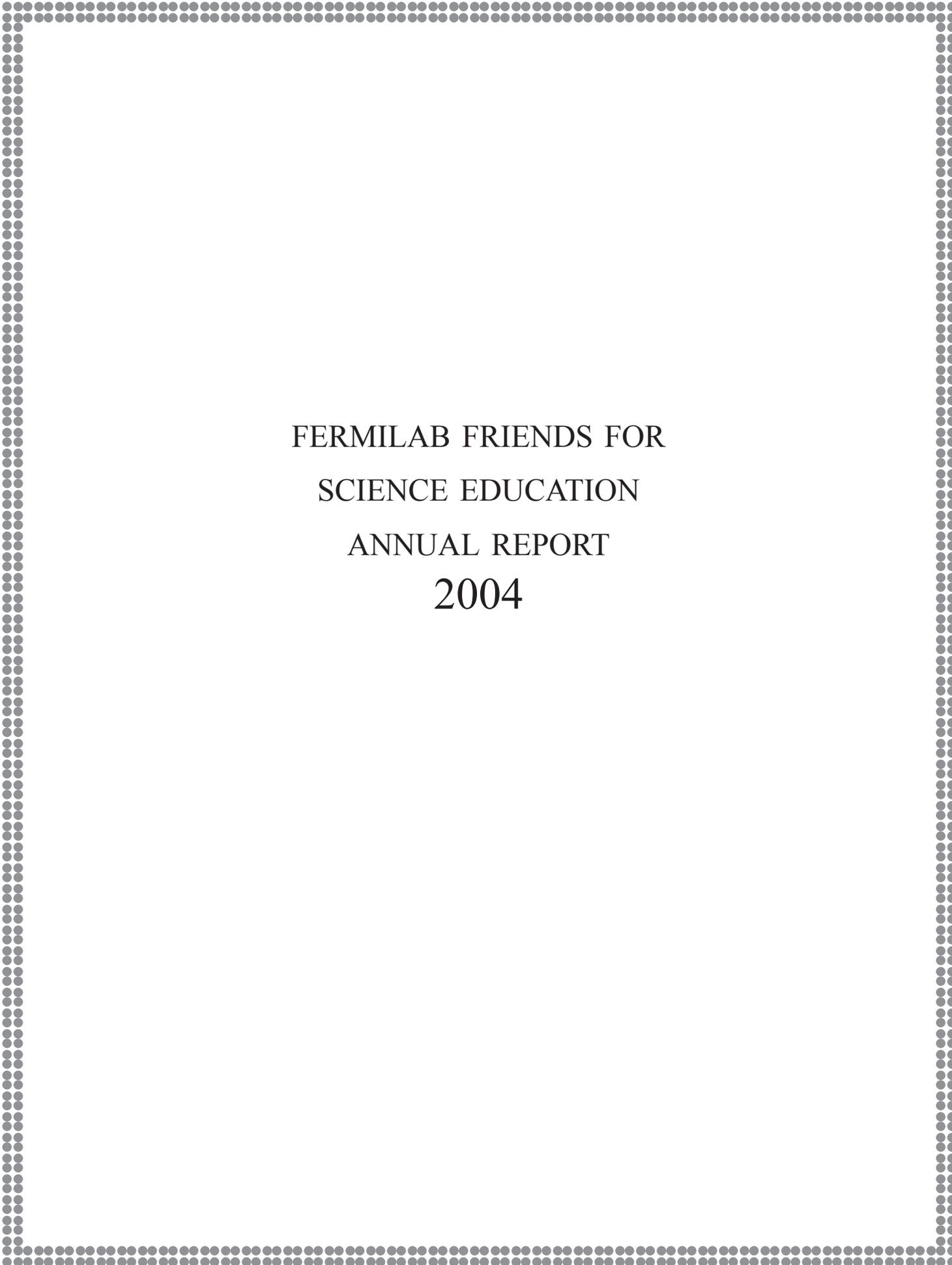


FERMILAB FRIENDS FOR SCIENCE EDUCATION



ANNUAL REPORT 2004





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SCIENCE EDUCATION
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2004

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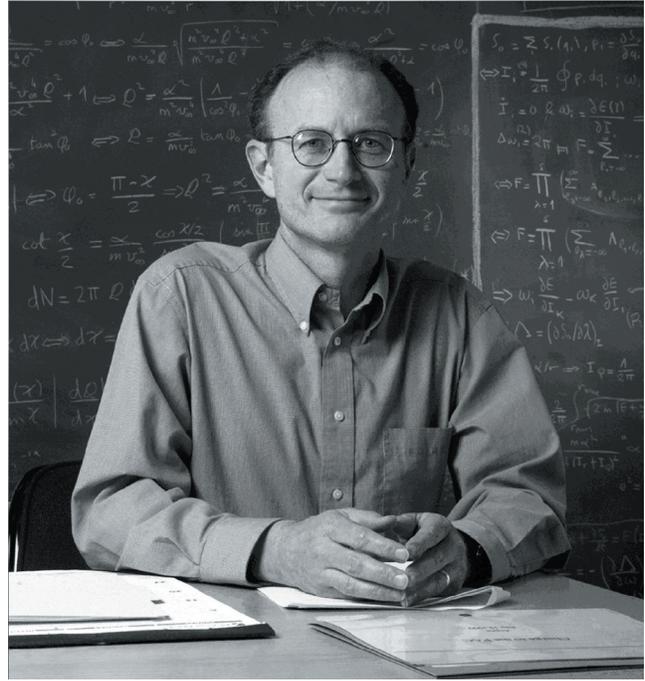
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Leaders in education, government, and industry regularly stress the importance of doing a better job at teaching science. Our society needs to have a workforce that knows and understands science. Recently, the Hart-Rudman Report on National Security emphasized the importance of training “the needed numbers of science and engineering professionals as well as qualified teachers in science and math.” We also need a broad community of people with sufficient education to understand the many scientific issues that have an impact on our public life.

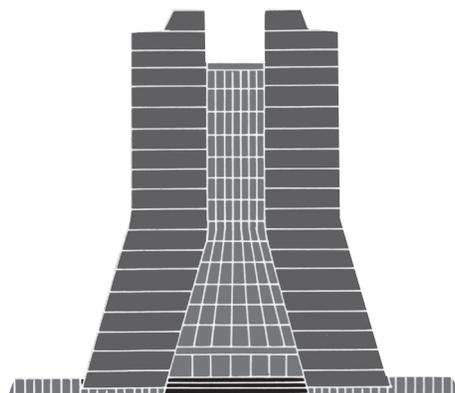
It is easier to diagnose this problem than to know how to fix it. In this environment, the experience of the Fermilab Education Office is particularly valuable. As a result of its programs, the students in the surrounding communities are receiving the full benefit of the special resources that are available at a great scientific laboratory. We need the continued strong support of Fermilab Friends for Science Education (formerly Friends of Fermilab) to maintain the quality of our science education programs.

I am grateful for the support that FFSE gives to the Education Office. FFSE and Fermilab have developed a uniquely productive partnership over seventeen years. Please help us keep up the good work.



Michael Witherell

*Michael Witherell, Director
Fermi National Accelerator Laboratory*



Fermilab Friends for Science Education continues to fulfill its mission to:

- Encourage young people to pursue careers in science and engineering.
- Enhance the quality of precollege science education in public and private schools.
- Promote a broader public awareness and understanding of science.

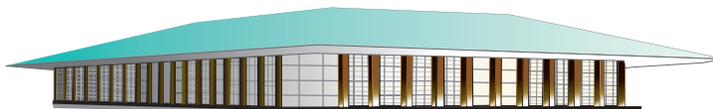
With support from Fermilab Friends for Science Education, the Fermilab Education Office is able to offer in-depth staff development programs that have a lasting impact on science education. These institutes and workshops have relatively high costs compared with other programs offered at the Lederman Science Center.

Fermilab Friends for Science Education supports Saturday openings of the Lederman Science Center. Among new initiatives FFSE has supported in 2004 are a new Director's Award for exceptional volunteer service to Fermilab K-12 education programs, the first year of the Summer Secondary Physics Institutes, two content sessions for the Illinois Mathematics and Science Partnership Area One Education Alliance and ENTICE workshops funded by the Illinois Department of Natural Resources. In addition, FFSE covers unusual program costs that grants may not cover; those "little things" are often the special touches that make teachers feel welcome at Fermilab.



Marjorie G. Bardeen

*Marjorie G. Bardeen, President
Fermilab Friends for Science Education*



WORKSHOP NEWS FOR 2004

Chicago Public Schools - Museum Partners

Over the past 6 years we have offered workshops in life and physical sciences at various grade levels. FFSE is the recipient of the grant from the Chicago Public Schools.

In 2004-05 Museum Partners moved the life science program from the spring session to the fall. As a result, Fermilab held four sessions; two at each grade level, one in the spring and another in the fall. Our theme for both workshops was insects. Felicia Svoboda and Dee Huie were instructors for teachers in grades K-4, and Sue Sheehan and Mary Jo Murphy were the instructors for teachers in grades 5-8. In the fall Priscilla Meldrim attended the first session for the life science teachers and described expectations for the Fermilab program. The teachers felt they were coming to the end of the earth and to see Priscilla helping direct traffic the day of the workshop gave them confidence that they were in the right place.

Fermilab held two physical science sessions for the Museum Partners Science Program: Gail Haynes and Anne Mary Teichert conducted the K-4 session; Haynes and David Hoppert, the 5-8 session. As in previous years, the theme for the K-4 session was electricity and magnetism, and the theme for the 5-8 session was indirect observation – exploring what can't be seen. However, Haynes and Hoppert revised the 5-8 session this year to include more of the history of atomic and subatomic exploration.

AREA I MATH AND SCIENCE PARTNERSHIP

FFSE partnered with the Illinois Area I Regional Offices of Education (DuPage, Grundy/Kendall, Kane, Lake, and Will Counties), Benedictine University and Argonne National Laboratory to offer a professional development program for teachers in five participating school districts. Each teacher attended a one-week workshop at Benedictine University, and another at either Argonne or Fermilab, and carried out action search during the 2004-05 school year to complete the program.

Teachers coming to Fermilab participated in either a physical science or life science workshop. The physical science workshop, taught by Bill Grosser of Glenbard South High School and Wayne Wittenberg of Benjamin Franklin Elementary School (Glen Ellyn) was a version of Phriendly Physics modified for teachers of older students (grades 4-8). Each school team received an experimental apparatus designed and built by Wayne. Workshop participants tried out the experiments to learn how their students will use the resources.

The life science workshop, taught by Pat Franzen and Mary Jo Murphy of the Education Office, was a blending of Particles and Prairies and From Beneath the Ashes. The teachers received materials to do a quadrat study at their school and to make a herbarium collection of prairie plants. Also, teachers selected items from a list of classroom materials to take back to their school. Participants in both programs and the external evaluator for the grant rated the Fermilab sessions highly.

The Education Office hosts the project Web site (www-ed.fnal.gov/imsp).

ENTICE

ENTICE (Environment and Nature Institute for Conservation Education) is an Illinois Department of Natural Resources program. FFSE received funds from IDNR for four teacher workshops in 2004. Plant a Prairie informed participants about planning and reconstructing a prairie. So many people registered for this workshop that we offered two workshops so all could attend. In June Pat Franzen and Ted Hoesel led a workshop, Introduction to the Prairie, and in October Sue Sheehan and Mary Jo Murphy led another on Insects: Our Friends. All were well attended, and the IDNR provided free materials and paid the instructors.



FERMILAB LInC 2004

The LInC team developed a new three-credit staff development program and materials for K-12 teachers to promote inquiry-based learning and effective technology integration in the classroom. Facilitators included Sharon Gatz and Stephen Meehan (Naperville School District 203) and Laura Mengel (Fermilab), who have just completed their tenth year on the LInC design and facilitation team.

In July, we welcomed 15 educators to the program from Algonquin, Burr Ridge, Naperville, Carol Stream, West Chicago, Downers Grove, Chicago Heights and Darien. They selected and customized an online project to support active student investigations on real-world issues. They developed projects on a wide range of topics including diseases, political propaganda, revolution, invasive species and oil extraction in Alaska parks.

In the fall, the participants field-tested their projects with students while sharing ideas, feedback and reflections with their colleagues and experienced mentors.

The first year's participants were enthusiastic about what they accomplished. Comments included:

[I learned] "How to incorporate a real life situation to bring kids into learning in the future; how to make them in charge of their own learning; . . . wow what a positive experience with what my students and I have learned together."

"Working on the project with students at the same time I was taking the class was most beneficial; that allowed me to discuss problems and get ideas on rubrics and management issues, and then go back to school and make changes with students."

"I have a good start to a project that I am very excited about. This class opened my mind up to a whole new way of teaching, less structured, more open-ended."

"We had time to actually experience an engaged learning project ourselves; it was a very

effective way to see how the process works; I enjoyed brainstorming ideas with others and building on the ideas of others."

"This was a great class; it gave me motivation and guidance as I worked through the project."

"I love watching my students go off on their own and be responsible for their own learning; they are having fun and learning; you can't beat that combination."

SUMMER SECONDARY SCIENCE INSTITUTES

The Summer Secondary Science Institutes (S3I) enjoyed a successful pilot of the physics program in the summer of 2004. Thirteen participants took part in one to four of the one-week sessions. Jason English of Fremd High School in Palatine, Paul Madson of Rosary High School, Aurora, and Edward Moyer, Proviso Township High School District 209 taught the workshops.

Participants in the workshops, which were intended for new teachers and teachers teaching out-of-field, engaged in hands-on experiments using traditional equipment and modern data-collection equipment on loan from PASCO Scientific. Additionally, the instructors facilitated discussions of the physics topics under study and reflection on the processes of teaching and learning. Each week also featured Fermilab scientists and engineers as speakers and tours of Fermilab facilities from the Linac to the Kautz Road Substation.

For its second year, the institutes will add a two-week biology workshop, taught by Tom Knutson, (recently retired), Glenbard North High School (recently retired) and Scott Iliff, Glenbard South High School.

A grant to FFSE from an anonymous donor supported the development of the workshops. The grant also subsidized the participant fee for the pilot year.



CONGRATULATIONS TO HONOREES!

SCHOLARSHIP WINNERS

This year three teachers received scholarships to attend Education Office workshops and two also received \$100 toward a field trip bus. Susan Abrant from St. Charles Borromeo School in Bensonville attended all three Phriendly Physics workshops and her students visited the Lab. Lynda Eberhart from Elm Elementary School in Burr Ridge attended all three Phriendly Physics workshops. Denise Engelman from Christ the King School in Lombard attended Particles and Prairies and her students visited the Lab.

HIGH SCHOOL STUDENT AWARDEES

Each year FFSE supports an awards program for outstanding science students attending high schools in DuPage and Kane counties. School faculty submits the names of up to two students who receive a certificate and two books at their school's award ceremony.

Winners in 2004 included:

Cody Brown and Josiah Gray, Aurora Christian High School; Roberto Gonzalez and Rudolfo Rodriguez, Aurora East High School; Julie Reger and Ken Heinz, Batavia High School; Josi Schwan and Dan Hadley, Burlington Central High School; Phil Buksa and Andrew Kiger, Community High School, West Chicago; Brian Phelan and Scott Leithem, Downers North High School; Robert Wakerly and Nicholas Fila, Downers South High School; Samantha Kumar and Oliver Gust-Osinga, Elgin Academy; Alyssa Huang, Fenton High School, Bensenville; Peter Killian and Sophia Willer, Geneva High School; Joe Miksan and Joann Youssef, Glenbard North High School, Carol Stream; Patrick Zeller, Glenbard West High School, Glen Ellyn; Swathi Reddy and Cindy Cheng, Hinsdale Central High School; Scott Yang and Sonia Goyal, Hinsdale South High School, Darien; Kelly Costello, Immaculate Conception H.S., Elmhurst; Rachel Grey and Shiloh Wehr, Larkin High School, Elgin; Steven Liu and Daniel Modaff, Lisle High School; Christopher Brown and Margaret Novotny, Montini Catholic High School, Lombard; Annie Millen and Tory Whitenhall, Rosary High School, Aurora; Gregory Eakins

and Steven Johnson, St. Charles East High School; Matt Bossemeyer and Leida van Oss, St. Charles North High School; Joseph Ekstrom and Stephanie Grouleau, West Aurora High School; Evan Breedlove, Wheaton Academy, West Chicago; Valerie Tonyan and Ashley Kramer, Wheaton North High School; Zubin Wala and Ryan Swearingen, Wheaton Warrenville South High School; Matthew Loar and Peter Le Mieux, Willowbrook High School, Villa Park; Anurag Patel and Jeffrey Salchenberger, York Community High School, Elmhurst.

DIRECTOR'S AWARD

FFSE supports a new Director's Award given to a Fermilab staff member who has made significant contributions to the Laboratory's K-12 education programs. The annual award of \$1,000, made possible by an anonymous donor, recognizes one volunteer a year whose contributions are outstanding, even among the many volunteer supporters of our programs. The 2004 award was presented to Sten Hansen by Mike Witherell



at the Volunteers Reception on November 14. Sten was cited for his work on data acquisition systems for student cosmic ray telescopes. Sten acknowledged the team that worked on the DAQ board including Curtis Danner and Terry Kiper who were also nominated for the award. Other nominees included Orlando Colo'n, Geoff Eargle, Don Lincoln, Paul Nienaber, Arnold Pompos and Jerry Zimmerman.



ARISE PROJECT UPDATE

The current ARISE project funded by Fermilab Friends for Science Education, overseen and guided by Leon Lederman and supported by Yvonne Twomey, Fermilab Education Office, is the production of what Leon calls a teachers “cut and paste” course guide. This guide will be a road map through 9th grade physics, 10th grade chemistry and 11th grade biology. The objective is to produce handbooks to tackle implementing the new sequence.

Questions such as “What topics do we teach in an introductory physics course?” “What math subjects must be taught concurrently with 9th grade physics?” and “What will the 11th grade biology curriculum look like?” form a barrier to implementing ARISE. These questions were among many discussed during meetings of teachers and school administrators from across the country at Fermilab in 2001 and at the 2002 San Diego National Science Teachers Association Conference. The result of these discussions was published as *Implementation Resource Book Suggestions from the Field* in March 2002. We plan to lower the Implementation barrier by providing answers to some of the questions regarding curriculum.

The curriculum guide begins in the middle, with chemistry. An enthusiastic, hard-working group has provided materials for the *Instructional Materials Guide Part 2 in Chemistry*. They are: Frank Cardulla, (retired), Niles North High School, Skokie, IL, Bill Grosser, Glenbard South High School, Glen Ellyn, and Lee Marek, University of Illinois, Chicago. The guide is available on the Education Office Web site (www-ed.fnal.gov/arise).

There has been an enthusiastic response to this document, which, instead of writing new materials, simply provides an informative index to exemplary educational activities, textbooks, laboratory activities or technology-based instructional materials chosen. Equally importantly, CONNECTIONS are emphasized: connections among various topics within chemistry, between the physics already learned and chemistry and between chemistry and

the coming attractions of 11th grade biology. Other topics addressed in the guide are: how to go about evaluating and choosing a textbook, the benefits of labs and demonstrations in teaching, and reflections on good principles in teaching chemistry, crystallized by our three teachers over the many years of their high school teaching experience.

Currently, we are focusing on the production of the physics section of the guide. For this, three physics teachers who have experience teaching physics to 9th graders are working with Leon’s active help and guidance. They are: Allan Etzbach, (newly retired), Naperville Central High School, Fred Myers, Farmington High School, Farmington, CT and Jim Szezol, Naperville Central High School.

We plan a similar format to the chemistry guide but with additional material including a suggested course sequence, the activities which show the phenomena and the relative amounts of time to be devoted to each topic, as well as advice on coordinating the student’s math studies with the physics studies. Some good news here is that an excellent text has just been published, joining the very few so far available for 9th grade physics.

Concurrently with work on the physics guide, we have begun the third section, the biology guide, by bringing on board Scott Greenhalgh, from Tempe High School in Arizona. Scott has had experience developing and teaching 11th grade biology course for his school, so he has identified the course topics.



PROGRAM HIGHLIGHTS

May – FFSE presented Fermilab Science Awards to 50 students from 27 high schools in DuPage and Kane counties. The FFSE Scholarship Program supported 3 teachers for workshop stipends and busses for 3 field trips.

June – We published the online 2004 *Educational Software Preview Guide*. This was the first time the guide, which was printed by the International Society for Technology in Education for 21 years, appeared fully implemented online.

July – Science Adventures were in full swing. One hundred sixty students attended 16 classes. Topics ranged from crime busters to Lego engineering and a bike camp.

August – A total of 69 teachers participated in seven workshops:

Beauty and Charm - (8 teachers)
Phriendly Physics – Electromagnetism - (4)
Phriendly Physics – Light and Heat - (4)
Phriendly Physics – Mechanics - (7)
From Beneath the Ashes - (2)
Particles and Prairies - (16)
Summer Secondary Science Institutes - (28)

September – Fermilab hosted the DuPage County School Board fall dinner. Some 150 people attended. Chris Quigg talked about what scientists want them to know about learning science. Leon Lederman also addressed the group.

October – Fermilab participated in the Secretary of Energy's What's Next Expo at Navy Pier for over 500 middle school students.

November - Fermilab invited over 250 staff members to a volunteer's reception honoring their work with Lab education programs and hosted by Mike Witherell. Sten Hanson received the first Director's Award for exceptional volunteer service to Fermilab K-12 education programs. FFSE received a grant from an anonymous donor for the award.

The Teacher Resource Center held the **Annual Regional Software Review**. It was attended by educators from six states. Travel and substitute expenses for the educators were paid by our partner, The North Central Eisenhower Mathematics and Science Consortium.

December – FFSE received a grant for \$30,000 to support World Year of Physics programs.

Fermilabyrinth was listed in the Digital Dozen, a list of exemplary Web sites selected by the Eisenhower National Clearinghouse.

January – QuarkNet held the first in a series of cosmic ray parties. Held during the World Year of Physics, teachers and their students set up a detector array to gather data for shower studies. The data was uploaded to the QuarkNet/Grid portal where students could analyze it and publish posters on their work. Over 200 students visited the Lab to see the array and the Tevatron detectors.

February – The Education Office hosted a family open house for the World Year of Physics. Held in Wilson Hall, activities included hands-on activities, Ask-a-Scientist, and visits from “Einstein,” “Fermi,” and “Feynman” and “Norton Nabs a Nu,” a Dr. Seuss-style tribute to Pauli. About 2000 people of all ages attended. Much of the financial support came from a grant to FFSE.

March – FFSE supported four workshops for the Chicago Public Schools Museum Partners Program: two physical science workshops and two life science workshops targeting grades K-4 and 5-8.

Weird Science presented the Wonders of Science show. Ramsey Auditorium was sold out for the event.

April – During the year over 13,971 students visited the Lab for one of our field trip or tour



The success of the 2004 FFSE programs rests with these outstanding program leaders.

Michael Bachrodt, Fremd High School, Palatine
Nancy Berkas, NCEMSC, Naperville • Richard
Billings, Glenbard West High School, Glen Ellyn • Joseph Cave,
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District 203, Naperville • James D. Cox, Clarendon Hills Middle School,
Clarendon Hills • Karl Craddock, Fremd High School, Palatine • Robin
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cia M. Franzen, Wild Enterprises, Metamora • Sharon Gatz, Beebe
Elementary School, Naperville Gail Green, Keller Junior High School,
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Tamra Hack, Plainfield School District 202, Plainfield • Lynn Hamper,
Naturalist, Aurora • Karen Jensen, Aurora East School District 131, Aurora
Bernard J. Jokiel, Washington Middle School, Aurora • Randy Jones,
Glen Ellyn School District 41, Glen Ellyn • Marge Keefe, St. Charles School
District 303, St. Charles • Steve Keefe, Batavia School District 101, Batavia
Cheryl LaMaster, St. Charles North High School, St. Charles • Paul Madsen,
Rosary High School, Aurora • Lee R. Marek, University of Illinois,
Chicago • Chris Marszalek, Twin Groves Junior High School, Buffalo
Grove Stephen Meehan, Naperville Community School District 203,
Naperville • Jill Mueller, West Chicago Middle School, West Chi-
cago Mary Sue Offut, SciTech and Field Museum Volunteer, Aurora • Cynthia
Pattison, NCEMSC, Naperville • Pat Pentek, West Chicago Middle School,
West Chicago • Sher Renken, Waubonsie Valley High School, Indian Prairie Unit
School District 204, Aurora • Linda Richards, Batavia School District 101, Batavia
Barbara A. Romack, Kaneville North Elementary School, Elburn
Robert Thompson, Glen Ellyn School District 41, Glen Ellyn • Sharon
White, Grissom Junior High School, Tinley Park • Patricia Witte,
Naperville • Wayne R. Wittenberg, Glen Ellyn School District 41, Glen Ellyn
Barbara Youngren, NCEMSC, Naperville • Jerry K. Zimmerman, Fermilab
Anna Zuccarini, Crone Middle School, Naperville

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Melissa L. Clayton, Administrative Support Assistant • Susan M. Dahl, Educa-
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A. Jordan, Education Specialist • Nancy Lanning, Public Information Specialist • Waylon
Meadors, Computer Specialist • Priscilla B. Meldrim, Public Information Specialist • Susan
Mendelsohn, Assistant Education Specialist • Laura A. Mengel, Computer Specialist • Spen-
cer L. Pasero, Education Specialist • Robert Peterson, Education Specialist • Elizabeth K. Quigg,
Computer Specialist • Diana Smailus, Administrative Support Assistant • Gayle Stephens,
Administrative Support Assistant

***Docents facilitate student field trips and other Education Office activities
and supervise the Lederman Science Center.***

Lynda A. Ballingall • Karen Bass • Susan Dumford • Mary Hawthorne • Gail Haynes • H. Ted Hoesel
Helen D. Huie • Jacqueline J. Krock • Wendy G. Mouche • Mary J. Murphy • David R. Seymour • Sue Sheehan
Mary Ann Stowell • Felicia Svoboda • Anne Mary Teichert • Yvonne Twomey • William Welch • Larry Welsh



REVENUES AND EXPENSES

<u>Revenue/Contributions</u> (\$ 000)	2003 (audited)	2004 (audited)	22 Years (1982-2004)
Public Agencies	\$ 103.3	\$ 8.0	\$4196.4
Private Foundations	48.3	75.6	636.5
Membership	14.3	20.6	280.4
Other	10.6	38.5	352.6
Total Revenue/Contributions	<u>\$ 176.5</u>	<u>\$142.7</u>	<u>\$5465.9</u>

<u>Expenses</u>			
Programs	\$119.7	\$68.1	\$3928.9
Administrative Overhead	24.0	29.0	1339.3
Total Expenses	<u>\$ 143.7</u>	<u>\$ 117.1</u>	<u>\$5268.2</u>
Excess (Deficit) of Revenue/Contributions over Expenses	<u>\$32.8</u>	<u>\$25.6</u>	<u>\$197.7</u>



ACKNOWLEDGEMENTS

Fermilab Friends for Science Education depends entirely on contributions and grants. We thank the Fermilab Friends for Science Education members, Tree of Knowledge contributors and the following organizations for their generous support of Fermilab education programs.

United State Department of Energy
Universities Research Association, Inc.
North Central Regional Educational Laboratory
Midwest Consortium for Mathematics and Science
Education
Chicago Public Schools

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May 2005

