Educational Outreach at Wilson Laboratory

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Goals of Educational Outreach

• Wilson Laboratory utilizes its Educational Outreach Program as a means of promoting an understanding and excitement in the realm of physical science throughout the community.
  - K-12 students and teachers
  - Undergraduate and graduate students
  - General public

• The Educational Outreach program recognizes the need to increase meaningful interactions between scientists, teachers and students.

• An important component of the program is the outreach opportunities available for graduate students. The benefits of involving graduate students include:
  - A positive rapport with school children and teachers
  - A strengthening of the culture of outreach outside of the Lab
  - A potential for fostering interest in graduate students pursuing science teaching
Strategies to Reach the Target Audience

• Strategies that are being used by the Lab to reach our target audience include the following techniques:

• The General Public:
  - Create and distribute educational materials as well as provide guided tours of Lab facilities

• K-12 Students:
  - Produce valuable hands-on lesson plans and provide meaningful side-by-side interactions with scientists

• K-12 Teachers and Undergraduates:
  - Provide unique research and educational opportunities, appropriate mentorship and the framework necessary to actualize their results
Focus: Outreach

• Past outreach activities have been based upon the inspiration of individual Lab members
  - Additional collaboration and consolidation will allow these outreach activities to become part of a comprehensive outreach program at Wilson

• The Educational Outreach Coordinator position was filled September, 2001 and has been created in an effort to:
  - assess existing outreach activities
  - expand successful activities
  - engage additional participants
  - organize an effective Outreach program

• The Outreach Coordinator’s background in public school science education will allow particular attention to be given to increasing successful outreach endeavors that occur in K-12 learning institutions.
Focus: The General Public

- In 1995, Wilson produced & distributed an educational video:
  - “A Visit to the Wilson Synchrotron Laboratory”
  - Shown to all visitors who tour the facility

- Presentations to the community & various schools given by members of the Laboratory & graduate students
  - Keynote address given at the Expanding Your Horizons conference geared towards middle school girls
  - Presentation given Corning Community College’s “Math Career Day” for area high school students
Focus: The General Public

- Designed and posted educational web pages
  - Provide basic information about the purpose of the Lab
  - Contains links to operational units & research groups
  - Explanatory computer graphics & virtual tours
  - Links to helpful information and resources

- Hosted a “Poet in Residence” (2000)
  - Sponsored by the Community Arts Partnership in Ithaca

  “Control room owl shift
  Bright in darkness: move – switch – flick
  Great! The beams collide!”
  - Wilson staff haiku

Radio Frequency Acceleration Cavity:
Demonstrates how beams are accelerated

“Synchrotron Haiku” by the poets of Wilson Lab
& “Tuning the Beam” by Bridget Meeds (2000)
Focus: The General Public

• Created and distributed an educational brochure titled: “The Science at Wilson Laboratory”

Diagram and explanation of chemical vapor deposition (CVD) technique used by CHESS facility

• Lab faculty, researchers and graduate students provide guided tours of the Wilson Lab facility

Tunnel view of CESR seen by visitors of Lab
Focus: The General Public

- Ithaca Sciencenter - A hands on museum located in the city of Ithaca which contains exhibits and exhibitions provided to allow the community to learn and explore science

- Wilson Laboratory donated $3000 to the Ithaca Sciencenter during 2001 in order to fund the center’s “Expansion Project”
  - Individual Lab members made financial contributions not included in above amount

- A Wilson faculty member serves on the Sciencenter Advisory Board

- Graduate students received a grant from NY State Section of APS to build a Cloud Chamber as a student project
  - The chamber and accompanying signage have been donated for display at the Sciencenter

- Effort has been placed on coordinating additional outreach activities and sessions with the Sciencenter
Focus: K-12 Students

- Sciencenter – Home School Community
  - Program organized by Cornell Center for Materials Research
  - Students age 8 – 16 presented with lessons on various topics
  - Wilson Lab hosted sessions on the topics of Diffraction and Cosmic Rays
  - Sessions involved hands-on participation by graduate students and faculty

Older students cooperate and share responsibilities in building their cloud chambers

Parents help younger students build their cloud chambers

Joel Brock from CHESS reviewing the basic principles of diffraction
Focus: K-12 Students

- In 1999, faculty from Wilson collaborated with CCMR to write and facilitate a lesson on “Tye-Dye and the Science of Color” at Cornell University to visiting families. 
  
- In 2001, the Lab hosted a student from the NASA Summer High School Apprenticeship Research Program PLUS:
  - Program promoting representation of minority students
  - Student research involved studying the structure of proteins under cryogenic conditions by using X-ray diffraction at CHESS

- “Slaterville Youth Commission” – Saturday Club
  - Innovated and coordinated by Lab staff member
  - Donations of old Wilson computers and parts to the club
  - Volunteers help kids assemble, operate & donate computers
Focus: K-12 Students

Chemistry Fairs – “Electricity and Magnetism”

Pyramid Mall Chemistry Fair 11/3/01
~ 300 students visited the booth

Dryden Elementary School 2/7/02
~ 250 students visited the booth

Jana Thayer, a graduate student, teaches community members about the Van de Graff generator

Fifth grade student helpers teach other students about E & M
Focus: K -12 Students

• “Atoms for Kids”
  - After school enrichment program
  - Program created based upon inspiration of faculty member
  - Cayuga Heights Elementary School, Fall 2001 & Spring 2002

  Jim Alexander and student volunteer describing the movement of atoms in a solid

• “Varna Science Club”
  - After school program, grades 3-8
  - Programs on various science topics including electricity, microscopes and spectroscopy
  - Fall 1999 to Spring 2002

  Ken Finklestein explains how young students can create an electromagnet
Focus: K-12 Students

- South Hill Elementary School - Spring, 2001
  - First grade class visited Cornell
  - Included a guided tour of Wilson
  - Liquid nitrogen demonstrations

- Newfield Middle School’s Science Day (1997 – 1999)
  - Lab members gave presentations on X-ray diffraction

- CHESS provides demonstrations of crystal mounting, data processing and structure solutions to visiting school groups
Focus: K-12 Students

• “Career Exploration: Focus on Teens” - June, 2002
  - Cornell Cooperative Extension program
  - Wilson Lab will host a three day workshop
  - Designed to expose students ages 15 – 19 to careers in accelerator physics and X-ray experimentation
  - The workshop will include tours, data interpretation, hands on activities and computer simulations/tutorials

• In conjunction with the “Career Explorations: Focus on Teens” workshop, Wilson will create an abbreviated “Tour Guidelines” booklet for graduate students, researchers and faculty to use when giving guided tours to visiting school children

• “Expanding Your Horizons Conference” – Spring, 2001
  - State-wide effort geared towards middle school girls
  - Cornell’s role in promoting math and science related careers
  - Wilson’s female graduate students hosted a series of workshops on Cosmic Rays and Cloud Chambers
  - This workshop will be hosted again in Spring, 2002
Focus: K-12 Teachers

• Coordinated Research Experience for Teachers (RET) program in collaboration with Wayne State University and Cornell University (1998-2001) = 9 participants total

• The intent of the 6-week summer program is to provide high school physical science teachers with:
  - Access to the research conducted and facilities available at Wilson Lab
  - The resources and supervision necessary to understand the science
  - The framework necessary to create or improve physics curriculum

• Evaluations of the program reveal the following benefits:
  - Increased stature with the students
  - Increased ability to teach science to students
  - Clearer view of the world of science
  - Rewarding form of professional development
  - Opportunity to create valuable instructional tools
Focus: K-12 Teachers

• Innovated a workshop with NASA’s CONTOUR Mission and its Educational and Public Outreach Coordinator
  - “Enhancing Physical Science Curricula – Bringing Particle Physics and Planetary Science into the 21st Century”
  - Host a six day workshop for eight high school physics and earth-science teacher in July, 2002
  - Grant awarded from Space Science Consortium
  - Graduate student and faculty participation

• The workshop goals include refining lessons on the following:
  1. The Standard Model
     - 2002 New York State Core Curriculum
  2. Scale and Measurement
  3. Physics as Inquiry
  4. Planetary Science
**Focus: K-12 Teachers**

*Continued...*

- **Workshop participants will receive:**
  - A bound version of the four refined and piloted lessons
  - Access to Material Kits that contain the supplies necessary to conduct the lesson in their classroom
  - An invitation to attend the Cornell Institute for Physics Teachers workshop in 2003

- **Cornell Institute for Physics Teacher’s workshop**
  - Sponsored by Cornell Center for Nanoscale Systems
  - Three week workshop scheduled for Summer, 2003
  - Presentations on lessons used to teach the Standard Model will be given by former “Enhancing Physical Science Curricula” workshop participant(s)
Focus: Undergraduate Students

- Coordinated the Research Experience for Undergraduates programs with Wayne State University and Cornell University (1998-2001) = 70 participants total (25 female, 15 minority)
- The major emphasis of 10-week summer program is to bring unique research opportunities to students otherwise not be available to them
- Group housing provides a sense of camaraderie to this diverse group of students

- New research from one REU project was featured at the American Institute of Physics Centennial in Atlanta in March, 1999
Focus: Undergraduate Students

- The Lab provides unique educational and research experiences for undergraduate students at Cornell University.
  - The Lab employs over fifty undergraduate students each year, in both part-time and full-time summer positions to perform research related jobs.
- Cornell Physics department offers a variety of courses offered to non-science majors. Three of the more popular courses offered are taught by Lab personnel:
  - “Why is the Sky Blue and All That” – Ahren Sadoff
  - “Physics of the Heavens and Earth” – Hasan Padamsee
  - “Physics in the News” – Nari Mistry
- A total of 250 students enrolled in the above courses during the 2001-2002 academic year.
Focus: Future Outreach Activities

• Design and post web pages for school children
  - Interactive with self paced tutorial
  - To provide background for tours groups
  - To learn about the science at Wilson Lab

“The picture above is a simulated image of gas density in our universe at present day. The each of the longer gas strands in the image exceed 100 million light years in length with low density gas colored blue and high density gas colored red. The red spots (high gas density) matches the observed galaxy cluster distribution. Each galaxy would contain tens of billions of stars”

• Develop effective assessment tool for evaluating current and future educational outreach programs

• Institute a ‘Library Lecture Series’ at a local elementary school where volunteer scientist give a 40 minute presentation to a group of students during their lunch period
Focus: Future Outreach Activities

• Wilson Lab will assist Cornell Administration in increasing the interdisciplinary efforts of the various Educational Outreach programs at the University

• The established K-12 Education and Outreach Programs at Cornell that Wilson Lab has collaborated with include:
  - CONTOUR Education and Public Outreach
  - Cornell Center for Materials Research
  - Cornell Center for Nanobiotechnology
  - Cornell Center for Nanoscale Systems
  - Cornell Institute for Biology Teachers
  - Cornell Teacher Education Program
  - Cornell Theory Center

• The facilitators of each of these programs meet regularly as part of the effort to work together to share ideas, discuss effective outreach strategies and support each others unique educational outreach endeavors