



It's Not Just a Good Idea...

Education and Outreach in Particle Physics

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Science Drivers...

Big Questions and Technical Challenges

- Big Questions...
 - Mass
 - The nature of spacetime
 - Symmetries
 - Dark Matter
 - Dark Energy
- Technical Challenges...
 - Accelerators
 - Detectors
 - Cyberinfrastructure
 - Analyses

Addressing: The Big Questions...

Meeting: The Technical Challenges...

- We must have
 - A thriving and vibrant scientific program.
- We need
 - A skilled scientific workforce and infrastructure.
 - An understanding and supportive public.
 - International collaboration and cooperation.

The Scientific Program

Some key elements

- The LHC:
 - Compelling physics potential and output.
 - Strong public awareness.
 - A strong and persistent education program.
- The ILC:
 - Compelling physics potential.
 - Credible cost and international partnership.
 - Strong public awareness.
 - A strong and persistent education program.
- Non-accelerator Physics/Neutrino Physics/Underground Science:
 - Compelling physics potential and output.
 - Credible cost.
 - Interagency partnership and international partnership essential
 - Strong public awareness.
 - A strong and persistent education program.

Framing the importance of our science

Public Relations and Education & Outreach

- Public Relations:
 - The Voice
 - The skill to convey a message
 - Targeted audiences
 - Directed and specific
 - Rapid timescales
 - Pivotal

- Education & Outreach:
 - The Eyes and Ears
 - The trained senses to see, hear and appreciate the message
 - Targeted audiences
 - Directed but broad in coverage
 - Evolutionary timescales
 - Transformative

Timescales

What are the implications

- A Graduate Student in 2020
 - Age 23 then
 - Age 9 now
 - An elementary schooler...
 - What career path will this young person choose?
- A Senior Physicist in 2006
 - Typical Age 50 now
 - Age 64 then
 - Retirement age looming...
 - What will be her/his legacy?

Formal Education

Opportunities

- We need to work within the education process at all levels.
 - Professional development for teachers and students
 - One-on-one mentoring.
 - Immersive research opportunities.
 - On experiments
 - In test beams
 - Analyzing data
 - Designing and building R&D equipment
 - Involvement in professional meetings
 - Classroom enrichment
 - Opportunities for in-class exposure to:
 - Real research
 - Meaningful experimentation
 - Alignment with Standards
 - Teachers essential to develop these elements
 - We need to collaborate with other scientists, computer scientists, and educational disciplines.
- Work with undergraduate degree granting institutions, community colleges, junior colleges
- Work/Study/Internships with the private sector and at National Labs
- Working with education schools that train teachers for primary and secondary education

Informal Education

Opportunities

- New exhibits to engage the public in forefront science
 - Accelerators, Particle Beams, Detectors
- Strengthening methods that provide a broader educational experience
 - Pre-visit or pre-lecture background or exposure.
 - Post-visit follow up activities and opportunities.

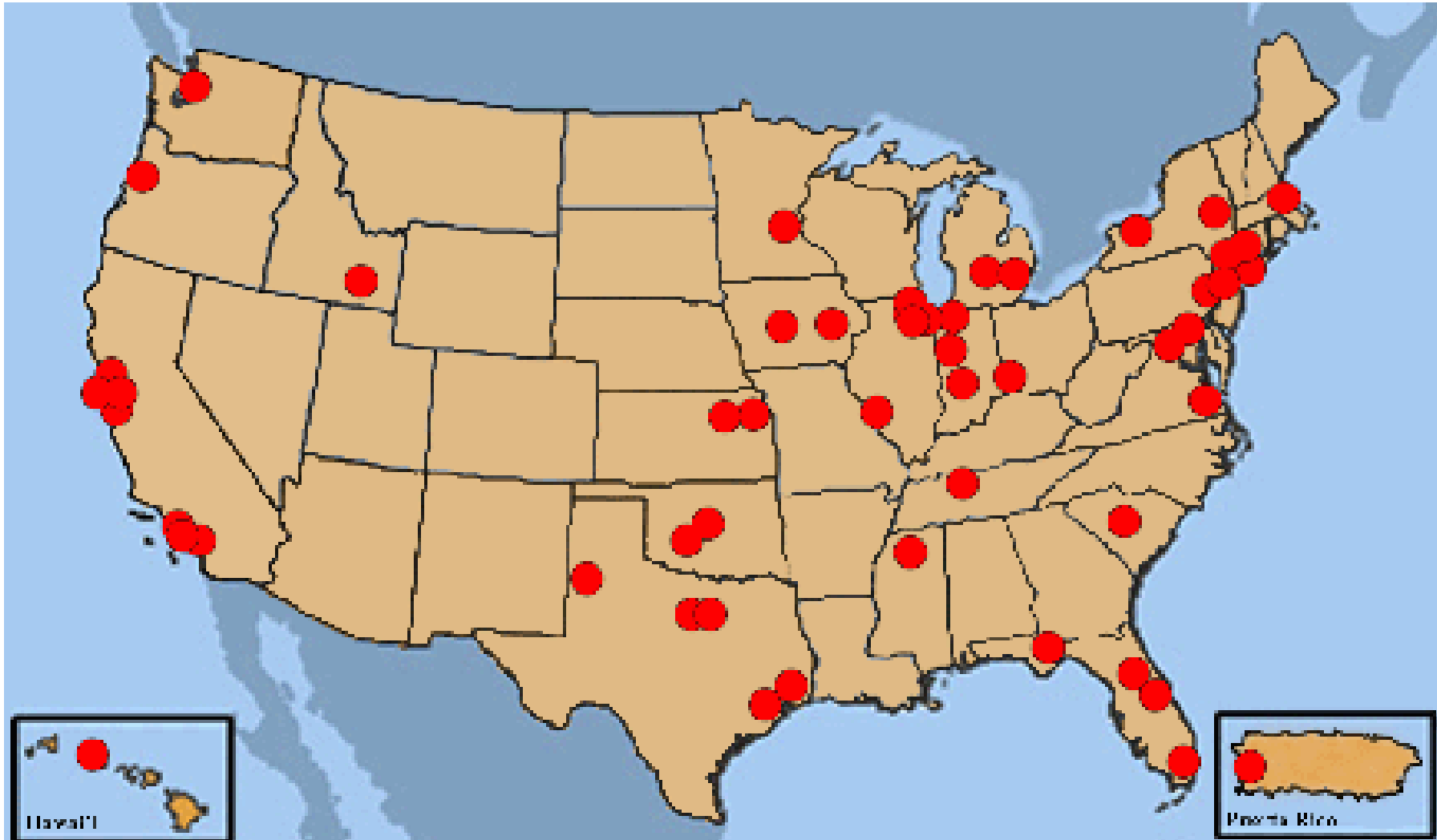
The Reach of E&O Programs

Research and Educational Experiences for HS teachers and students

- Continental
 - NALTA (ALTA/WALTA/CROP/SCROD/CHICOS/QuarkNet)
 - National (25 States + Puerto Rico)
- National
 - QuarkNet (25 States and Puerto Rico)
- State
 - CROP (Nebraska)
- Regional
 - Mariachi (Long Island)
- County
 - CHEPREO (Miami, but including links to Brazil)
- Community
 - Your university or lab or school

Example: QuarkNet

Center Locations



E&O International

A new arena to develop

- A working group with representation from the regions
- The development of a plan for an international effort
- Current activity at ILC Workshops
 - Some effort is already underway:
 - At Bangalore – QuarkNet Cosmic Ray Grid Project
 - At this Meeting – Sessions and Cosmic Ray Program
 - At DPF Honolulu – Sessions and QuarkNet Program
- Have an E&O column or dedicated issue in the ILC Newslines, Interactions,...
- Engage senior scientists to help facilitate this effort

Education and Outreach

The impact of Senior Scientists and Researchers

- What will such individuals do to continue to make a difference?
 - Coordinated volunteerism
 - Working with the public
 - Helping with international efforts in E&O
 - Resource Persons
 - Working with elementary and secondary schools – in collaboration with professional teachers
 - Active guidance for non-traditional and underrepresented groups
 - Guiding immersive research experiences for younger students
 - including secondary students and undergraduates.

At NSF

Underlying Themes

- Empowering University-Based Investigators
- Adding Value
 - Partnerships
 - Building Interdisciplinary Collaboration
 - Broadening Participation
 - Single Investigators
 - Non-traditional/Underrepresented participants
 - RUI's (Research at Undergraduate Institutions)
 - Education and Outreach Activities

NSF & DOE Some Collaborative Examples

Intra-agency/Across Agencies

- **QuarkNet**
 - NSF MPS/EPP
 - NSF MPS/OMA
 - NSF EHR/ESIE
 - DOE/HEP
 - In Kind
- **CHEPREO**
 - NSF MPS/EPP
 - NSF OISE
 - NSF EHR/ESIE
 - NSF OCI
 - NSF MPS/OMA
 - In Kind
- **I2U2**
 - NSF MPS/EPP
 - NSF MPS/PHY
 - NSF MPS/OMA
 - NSF EHR/TPC
 - NSF EHR/ISE
 - NSF EHR/IMD
 - In kind
- **Lederman Science Center**
 - DOE/HEP
 - DOE/SCI
 - NSF(QuarkNet, I2U2)
 - State of Illinois
 - Private Foundations

Education and Outreach

Some discussion points

- International E&O planning
 - Including Regional planning
 - A working group
 - Value added to existing programs
- Engaging youth
- Engaging senior researchers and teachers
- Providing added value to ongoing programs
- Looking for new opportunities
 - Science and scientific collaboration
 - Geographic Reach
 - Nontraditional and underrepresented individuals and communities
- Informal education

Education and Outreach

In Particle Physics

- It's not just a good idea...
- It can be transformative
 - Professional Development for Teachers
 - Enrichment of the educational experience for young students
 - Reaching the public through new museum exhibits
 - Forging new international connections.
 - An invitation and welcome to our science.