CMS Masterclass:

QuarkNet teachers may bring selected students to participate in the Master Class, held each spring to:

- Learn to categorize particle collision events from the LHC CMS detectors.
- Enjoy a complimentary lunch.
- Rub elbows with the experts.
- Engage in a real time video conference with other high schools and scientists around the world!

QuarkNet and Science Standards:

Indiana (Physics)

P.2.3: Apply the laws of conservation of energy and momentum to analyze elastic and completely inelastic collisions.

P.2.4: (Kinetic, gravitational potential, elastic potential) can be transformed to other mechanical and non-mechanical forms.

P.4.5: Produced by and interacting with moving charges and magnetic materials.

P.7.2: Positive and negative forces indicate a strong force, only evident within the nucleus.

P.7.4: Fission and fusion convert very small amounts of matter into large amounts of energy.

Next Generation

HS-PS1-3: Plan/conduct investigations to compare bulk scale structure to infer the strength of electrical forces between particles .

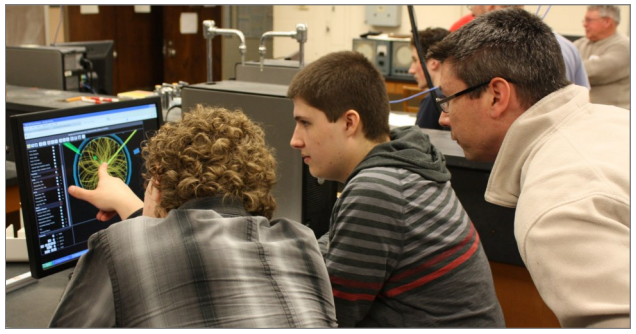
HS-PS3-5: Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

Literacy in Science

11-12.RS.7: Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem

11-12.RS.9: Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible .

Components of the CMS detector at CERN were actually built **in Physics at Purdue!**



MasterClass students learning to identify subatomic particles in CMS data from CERN.

Contacts for more information:

David Sederberg, Director of Physics and Astronomy Outreach; *dsederbe@purdue.edu*

Professor Matthew Jones, Purdue Physics; *mjones@physics.purdue.edu*

Applications for the QuarkNet Summer Institute at Purdue will be available on line mid March, 2015:

http://physics.purdue.edu/outreach/quarknet

QuarkNet

Helping Develop America's Technological Workforce

Summer Institute for High School STEM Teachers

June 27-July 1 2016

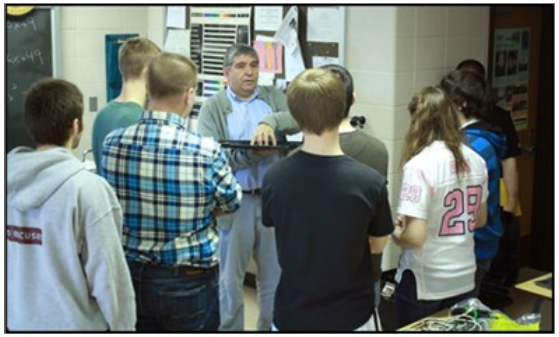
Purdue University

West Lafayette, IN

What is QuarkNet?

QuarkNet is a professional development program for STEM teachers, providing opportunities to engage in state-of-the-art research aimed at resolving some of the mysteries about the structure of matter and fundamental forces of nature.

In addition to the Summer Institute, QuarkNet provides academic year support to teachers by providing the loan of a cosmic ray detector in their classroom for demonstration, classroom activities and labs, and independent student research. We can also provide a guest speaker for your class.



QuarkNet National Staff Member presenting students with the challenges and rewards of cosmic ray research.

Program Goals for Students:

- Modeling systems and interactions that are not directly observable.
- Manipulation and interpretation of data.
- Engage in projects and activities designed to understand relativity and the standard model.
- Conduct authentic independent research at the extreme scales of space, mass and time.
- Understand the kinds of questions researchers want to ask and design ways to answer them.
- Explore relevant and potential career paths.

QuarkNet Summer Institute:

The Purdue QuarkNet Summer Institute provides five days of interaction with other STEM teachers, mentorship of Purdue research faculty. You'll have fist hand experience and training in using a cosmic ray detector and explore ways in which the QuarkNet program can expand your curriculum.

Teachers during the Summer Institute, measuring cosmic ray data on the roof of the parking garage.

So, What's With Cosmic Rays?:

- CRs allow accurate dating of ancient artifacts and materials by their effects on matter.

- They are believed to have had impact on the evolution and natural selection processes of life on Earth.
- They can help us understand fundamental particle physics.
- But, what are they and where do they come from?

What Will You Get?:

- Smarter!
- Experience interpreting evidence of particle collisions and the nature of particles produced.
- A new or better understanding of leading edge research and its applications.
- Inquiry-based experiments and activities for your students.
- Free use of a cosmic ray detector and software.
- Points or credit option toward license renewal.
- Academic year support from Purdue Physics and Astronomy faculty and Outreach staff.

What You Will Do:

- Attend a 5-day institute (with stipend).
- Engage in conversation and informal presentations with research scientists.
- Learn about the Standard Particle Model.
- Discover details about detectors.
- Investigate the properties of cosmic rays and learn how to classify events.
- Tour research labs, meet and talk to research scientists.
- Collect data with the same muon detector you will use with your students!
- Become part of a community of learners and support.