



Fermilab & QuarkNet: Remote Learning in Action

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International Particle Physics Outreach Group Collaboration Meeting

7 May 2020

Helping Teachers and Parents

In the transition to the current remote learning environment, the Fermilab Education and Outreach office and QuarkNet determined:

- We were already well-placed to start supporting teachers and parents in the work of remote learning, and
- We would be expanding our online offerings.
- Teachers have long seen us as a reputable resource.



The screenshot shows the Fermilab website with a blue header and navigation menu. The main content area features a notice about the closure of the Batavia site. Below the notice is a large photograph of a group of people participating in a walk or run on a paved path. At the bottom of the page, there are two smaller photographs: one of a family in a field and another of two boys in a laboratory setting. A 'Get FormiGear!' banner and social media links are also visible.

Fermilab Bringing Science Education to You

Fermilab | Programs | Science Adventures | Calendar | Registration | About | Contact | FAQ | Fermilab Friends

Home | Educators | Families | Employees | Students | Visitors | Internships

Fermilab Ed Site Search
Google Custom Search

Fermilab's Batavia site is currently closed to the general public.

As a precautionary measure related to COVID-19, the entire Fermilab site in Batavia is closed to the general public. This includes all tours, events, activities, classes, buildings, as well as access to the walking/bicycling paths. All public events and tours are cancelled, postponed, or held remotely through the end of May. Updates will be posted on this page. We appreciate your understanding.

Additional information on Fermilab's precautions regarding COVID-19 is located at: www.fnal.gov/covid19

Get FormiGear! Click Here

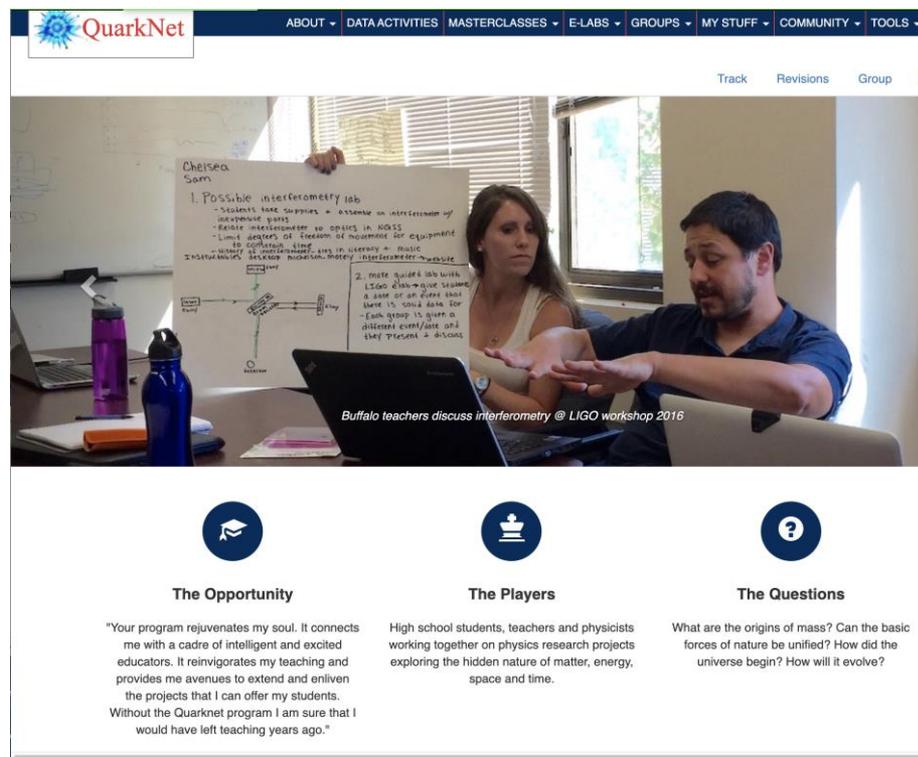
More ways to follow ...

Tweets

Helping Teachers and Parents

Both Fermilab and QuarkNet have rolled out new remote support for teachers, students, and parents.

In this talk, we'll describe new and expanded efforts rolled out over recent months and some future plans.



The screenshot shows the QuarkNet website interface. At the top is a navigation bar with the QuarkNet logo and links for ABOUT, DATA ACTIVITIES, MASTERCLASSES, E-LABS, GROUPS, MY STUFF, COMMUNITY, and TOOLS. Below the navigation bar is a video player showing two teachers, a woman and a man, sitting at a table with a laptop. The woman is pointing at a whiteboard that has handwritten notes and a diagram. The notes include the name 'Chelsea Sam' and two numbered points: '1. Possible interferometry lab' and '2. make guided lab with LIGO data-movie scenario'. The video caption reads 'Buffalo teachers discuss interferometry @ LIGO workshop 2016'. Below the video player are three circular icons: a graduation cap, a crown, and a question mark. Under each icon is a section title and a quote or description.

The Opportunity

"Your program rejuvenates my soul. It connects me with a cadre of intelligent and excited educators. It reinvigorates my teaching and provides me avenues to extend and enliven the projects that I can offer my students. Without the Quarknet program I am sure that I would have left teaching years ago."

The Players

High school students, teachers and physicists working together on physics research projects exploring the hidden nature of matter, energy, space and time.

The Questions

What are the origins of mass? Can the basic forces of nature be unified? How did the universe begin? How will it evolve?

Fermilab

Who have been the Fermilab education office's core audiences and how have we reached them?

- Teachers bringing students for field trips and attending teacher workshops
- High school students attending like the STEM Career Expo and Saturday Morning Physics
- Young students who come for Science Adventure classes
 - And their parents!
- The general public interested in learning more physics or about Fermilab



Fermilab

What are the best ways to reach those audiences virtually and what new audiences might we now have?

- Teachers: Looking for high quality online content for students learning from home
- High school students: Virtual learning opportunities like those previously available in person
- Young students and their parents: Fun and engaging at home science and information on how to help kids learn.
- Everyone: Use of social media and looking for interactive educational opportunities.

What is Fermilab offering?

New ways to virtually connect to the lab

- Resources gathered at our new “Families” webpage:
 - Grid of activities for students from grades 3–12, using the 5E education model to connect them into coherent strands. Helpful for those learning from home.
 - Recreating in person experience with virtual resources from the Lederman Science Center
 - Guidance for parents new to working with students at home

Particle Physics	Astrophysics	Prairies	Art	Arch
100	100	100	100	1
200	200	200	200	2
300	300	300	300	3
400	400	400	400	4
500	500	500	500	5

Team 1 Team 2 Team 3



What is Fermilab offering?

Online versions of Fermilab Education Office events:

- The remaining classes from the Winter Saturday Morning Physics session were held on later dates as online events
- The STEM Career Expo for high school students will be held virtually; the office has recorded five panels to date and will be posting them soon

Winter Session, 2020

January 9, 2020 | [aearly](#)



Please go to ed.fnal.gov for information regarding the cancellation of the remaining Winter 2020 session.

Lecture topics and dates are subject to change. The schedule will be updated accordingly.

Schedule of Online Lectures held via Zoom

Date	Lecture Topic	Speaker, Affiliation	Video Link
24-March-20	Informal Q&A – Standard Model	SMP Team	Video of Zoom Q&A on March 24
3-April-20	Galactic Astrophysics	Noah Kurinsky, Fermilab	Video of 4/3 Zoom Lecture
10-April-20	Extragalactic Cosmology	Adam Anderson, Fermilab	Video of 4/10 Zoom Lecture
17-April-20	Energy and Climate	Dan Hooper, Fermilab	Video of 4/17 Zoom Lecture
23-April-20	LHC Physics Keynote Presentation	Karrie DiPetrillo, Fermilab Christian Herwig, Fermilab Alexx Perloff, University of Colorado Boulder	Video of 4/23 Zoom Lecture
1-May-20	Nuclear Physics	Bryan Ramson, Fermilab	Video of 5/1 Zoom Lecture

What is Fermilab offering?

Social media engagement:

- We have ramped up our Twitter offerings to include the very popular “#CanYouGuess” feature, in which we ask our followers a question about particle physics, as well as:
 - #FNALFieldFinds and #FNALTreeID: natural science features captured in our backyards
 - #FNALatHome: activities for parents and kids to do together
 - #DidYouKnow: facts about Fermilab science and education

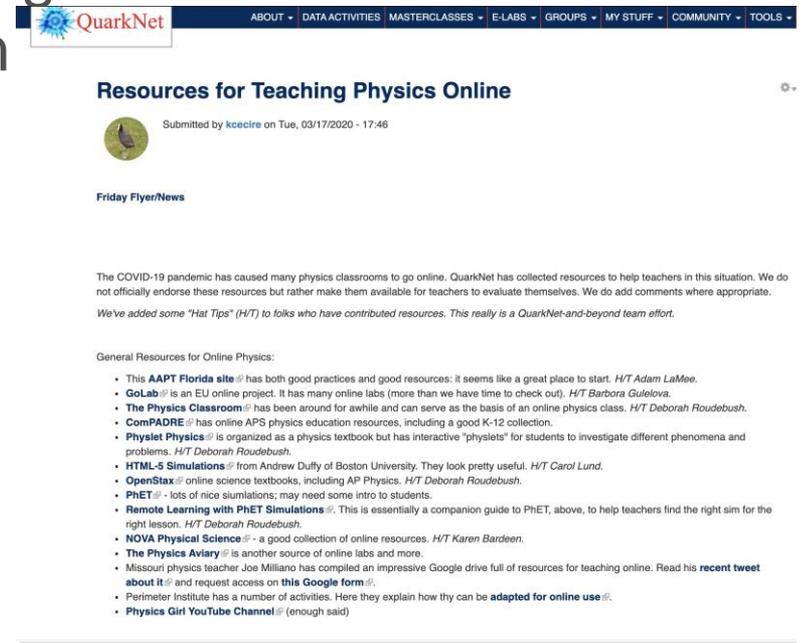


QuarkNet

QuarkNet's audience is primarily high school physics teachers; the QuarkNet program is focusing on providing them resources to enhance their teaching:

- Created a central page of resources from QuarkNet, Fermilab, and a wide variety of organizations dedicated to physics education; updated often

- General Resources for Online Physics
- Resources from Fermilab
- Particle Physics Resources

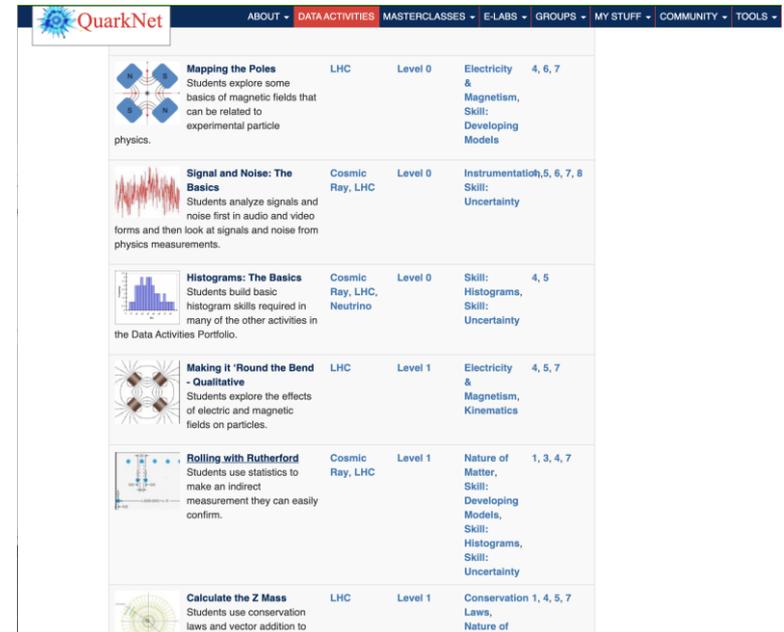


The screenshot shows the QuarkNet website header with navigation links: ABOUT, DATA ACTIVITIES, MASTERCLASSES, E-LABS, GROUPS, MY STUFF, COMMUNITY, TOOLS. The main content area is titled "Resources for Teaching Physics Online" and includes a submission date of "Submitted by kceelre on Tue, 03/17/2020 - 17:46". Below this is a section for "Friday Flyer/News" with a paragraph about COVID-19 resources and a list of "General Resources for Online Physics" including links to AAPT Florida site, GoLab, The Physics Classroom, ComPADRE, Phislet Physics, HTML-5 Simulations, OpenStax, PHET, Remote Learning with PhET Simulations, NOVA Physical Science, The Physics Aviary, and Missouri physics teacher Joe Milliano's resources.

QuarkNet

QuarkNet's audience is primarily high school physics teachers, so the QuarkNet program is focusing on providing them resources to enhance their teaching:

- Added a page of resources to help teachers and students do cosmic ray analyses online and another for CMS data
- Encouraging teachers to share ideas in the Data Activities Portfolio for adapting activities for online use
 - Staff wrote up their own ideas
 - Added comments in the portfolio
 - Made a centralized page to collect it all and make it public



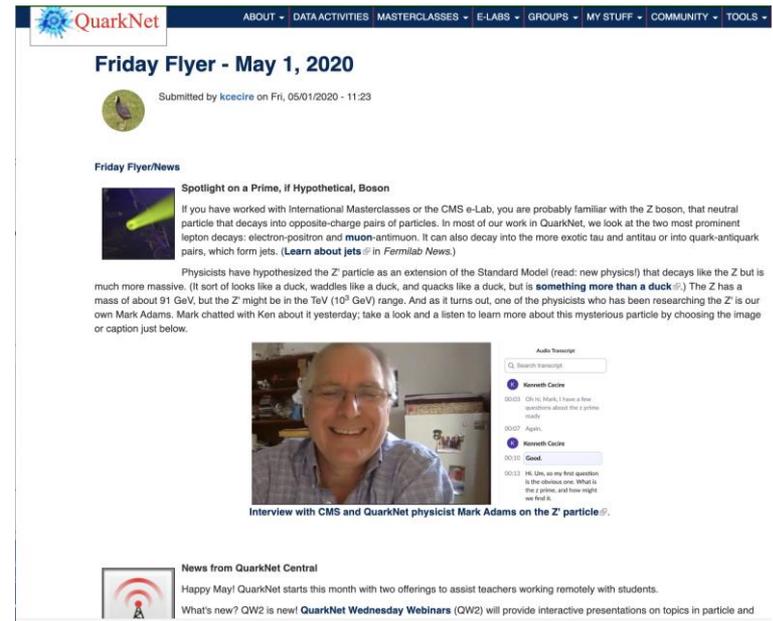
The screenshot shows the QuarkNet website interface. At the top is a navigation bar with the QuarkNet logo and menu items: ABOUT, DATA ACTIVITIES (highlighted), MASTERCLASSES, E-LABS, GROUPS, MY STUFF, COMMUNITY, and TOOLS. Below the navigation bar is a table listing various data activities. Each activity includes a small icon, a title, a brief description, the associated experiment (e.g., LHC, Cosmic Ray, LHC, Neutrino), the activity level (Level 0 or Level 1), and the relevant skills and standards (e.g., Electricity & Magnetism, Kinematics, Nature of Matter, Conservation Laws).

Activity Title	Experiment	Level	Skills	Standards
Mapping the Poles	LHC	Level 0	Electricity & Magnetism, Skill: Developing Models	4, 6, 7
Signal and Noise: The Basics	Cosmic Ray, LHC	Level 0	Instrumentation, Skill: Uncertainty	5, 6, 7, 8
Histograms: The Basics	Cosmic Ray, LHC, Neutrino	Level 0	Skill: Uncertainty	4, 5
Making it 'Round the Bend - Qualitative	LHC	Level 1	Electricity & Magnetism, Kinematics	4, 5, 7
Rolling with Rutherford	Cosmic Ray, LHC	Level 1	Nature of Matter, Skill: Developing Models, Skill: Histograms, Skill: Uncertainty	1, 3, 4, 7
Calculate the Z Mass	LHC	Level 1	Conservation Laws, Nature of	1, 4, 5, 7

QuarkNet

QuarkNet's audience is primarily high school physics teachers, so the QuarkNet program is focusing on providing them resources to enhance their teaching:

- Have modified the focus of the Friday Flyer:
 - "Spotlight" section has moved away from focus on QuarkNet centers to more topical items
 - "Resources" section points to external items of interest
- BAMC – covered in IMC talk
- Kicked off QW2 this week: a webinar series for teachers and students about particle physics



Friday Flyer - May 1, 2020
Submitted by keecire on Fri, 05/01/2020 - 11:23

Friday Flyer/News

Spotlight on a Prime, if Hypothetical, Boson

If you have worked with International Masterclasses or the CMS e-Lab, you are probably familiar with the Z boson, that neutral particle that decays into opposite-charge pairs of particles. In most of our work in QuarkNet, we look at the two most prominent lepton decays: electron-positron and muon-antimuon. It can also decay into the more exotic tau and antitau or into quark-antiquark pairs, which form jets. ([Learn about jets](#) in *Fermilab News*.)

Physicists have hypothesized the Z' particle as an extension of the Standard Model (read: new physics!) that decays like the Z but is much more massive. (It sort of looks like a duck, waddles like a duck, and quacks like a duck, but is **something more than a duck**.) The Z has a mass of about 91 GeV, but the Z' might be in the TeV (10^3 GeV) range. And as it turns out, one of the physicists who has been researching the Z' is our own Mark Adams. Mark chatted with Ken about it yesterday; take a look and a listen to learn more about this mysterious particle by choosing the image or caption just below.

Interview with CMS and QuarkNet physicist Mark Adams on the Z' particle

News from QuarkNet Central
Happy May! QuarkNet starts this month with two offerings to assist teachers working remotely with students. What's new? QW2 is new! **QuarkNet Wednesday Webinars (QW2)** will provide interactive presentations on topics in particle and

QuarkNet

QuarkNet's audience is primarily high school physics teachers, so the QuarkNet program is focusing on providing them resources to enhance their professional development:

- Retooled an upcoming workshop for QuarkNet fellows:
 - Initially planned to help fellows better support in-person workshops at centers this summer
 - Now focused on working with fellows to help them help centers transition to remote workshops
- Creating an online summer program on particle physics topics for teachers led by a Fermilab physicist



Summary

- Fermilab and QuarkNet both adding and expanding online and remote learning resources rapidly.
- Both serving as both resources and hubs for different audiences (with some overlap).
- Continuing to create, and always looking for more to share with teachers and students!