

QuarkNet Staff Monthly Report Activities of March 2020

Centers

Ongoing Staff Efforts – March is, of course, the month that the COVID-19 pandemic affected the world in so many ways, including the closure of facilities and a switch to online education for most U.S. schools, colleges, and universities. Much of the staff activity has been to move their own work to home and find ways to help QuarkNet teachers. Among the first and most important of these efforts by Shane, Spencer, and Ken was the production of a page on the QuarkNet website devoted to [Resources for Teaching Physics Online](#). They quickly followed this by opening six [QuarkNet Zoom Channels for Videoconferencing](#) on the Notre Dame account that teachers can use to facilitate contact with students and each other.

In addition to ongoing contacts and discussions, staff reports the following activities:

Colorado State University – Ken and Shane had a videoconference with lead teachers on March 7 to explain the ATLAS masterclass.

Kansas State University – The KSU teachers continue to collect data for their storm tracking project. Mark helped teacher Amy Hageman debug her DAQ-GPS system for use collecting data for tracking storms across Kansas. Martin Shaffer supported teachers and their hardware and has been extremely challenged keeping remote sites running.

University of Cincinnati – Ken met with Jeff Rodriguez and Mike Sokoloff on Zoom on March 23 to discuss their plans for Summer 2020 and evaluation work with Kathy Race based on her *Center Feedback Form*.

University of Hawaii – Shane connected several times with center leadership including Michael Jones, Veronica Bindi, Mary Kadooka, and Tiffany Coke to plan for a weekend CMS masterclass on March 14 and a muon-themed workshop for teachers on March 15. Both of these activities had to be canceled due to COVID-19; the center hopes to offer this combination of activities in 2021.

University of Illinois at Chicago – On March 5 and 25, Mark and Nate Unterman planned the dates and theme of the UIC-CSU summer workshop. They reviewed the status of the Eclipse paper for *Physics Teacher* and the paper on MUSE. Edmundo Garcia and Mark discussed canceling the April 3 masterclass and determined open dates for the summer workshop. A tour of Fermilab for center students scheduled for April 1 was canceled. Nate continues to update his golden files document. UIC's J array Jan–Mar 2020 data was uploaded and studied. Mark purchased some old pennies (Indian Heads, 1943 steel, and an 1840s thick penny) to enhance the penny mass activity.

University of Minnesota – Kathy Race and Shane had an in-depth conversation with Greg Pawloski and Jon Anderson on March 31 centered around the *Center Feedback Form*. This discussion focused on center activities over the past two years and included reflection on the degree to which center-level outcomes and success factors were met during this two-year interval. This discussion also provided the opportunity to consider ideas for future center activity.

University of Notre Dame – Ken went to Marian High School on March 9 to help students prepare for their ATLAS masterclass. They analyzed data in school and at home and then, on March 12, came to Notre Dame to finish with Ken facilitating. This turned out to be the last masterclass at Notre Dame for the season. Ken met students at Winamac Community High School and their

teacher, Jeremy Wegner, online on March 14. They completed their masterclass, originally scheduled for Notre Dame, from their homes on March 17. Ken participated in a Notre Dame weekly meeting on Zoom on March 23. Ken participated in the Notre Dame Department of Physics Outreach Committee meeting via Zoom on March 20 and 27.

Cosmic Ray Studies

Statistics from e-Lab: 703 cosmic ray uploads; and 74 cosmic ray plots during February 28–March 26, 2020. Mark collected data with Fermilab WH15W detectors. Both detectors were left running, hoping to continue flux and large array data. On March 4, Mark moved the detector and flipped the vertical positions of the muon flux experiment so that it formed an active backdrop for masterclasses hosted from WH15W. Mark's last day physically at Fermilab was March 11. He moved CRMD components of DAQ 6674 to his home, assembled flux and muon speed experiment, and uploaded data for general use. The detector timing was calibrated so data can be used in the simplified speed measurements in the portfolio. Dave restarted the WH15W detectors on the very last day before access to the Fermilab site was restricted.

Mark drafted an introduction e-Lab analyses, incorporating a list of golden files compiled by Nate and Mark, and e-mailed the reminder to all of e-Lab's QuarkNet teachers that analyses of existing data which might be useful in their remote teaching effort. With help from Shane and Ken, Mark is adding a more comprehensive document to the Drupal resources. Mark mentored Tyler Strohl on March 2 and 9. Tyler plateaued both counters of his unique hand-held pointing scintillator pair. They made plans to move the detector to Tyler's home and upload software onto his home PC, anticipating a halt of public visitation at Fermilab. However, Fermilab was shut down to the public and St. Charles High School halted mentoring programs before our next visit, so the project is currently on hold. Edit and Mark continue to make progress on the new lifetime module's logic flow.

The monthly Cosmic Ray fellows phone conference was held March 24. Topics discussed were COVID-19 school district responses and possible e-Lab introduction to remind teachers about data analysis opportunities; status of mid-May fellows meeting at Fermilab; continuing with summer workshop planning; updates on the MUSE experiment and Kansas' storm tracking effort; three new CRMDs being sent out; the Ad Board's strong support of cosmic ray efforts and assessment of MIT's inexpensive CosmicWatch; and scheduling the next phone conference on April 24, with a shift to Zoom.

LHC Physics

Once International Masterclasses were canceled (see below), Ken began to build a simplified masterclass that could be done by students at home with online help from teachers. By March 30, 31 teachers had registered; most were QuarkNet teachers and a few were colleagues from outside the U.S. The masterclass, Big Analysis of Muons in CMS (BAMC), has students only examine muon events in the current CMS masterclass; muon tracks are easy to pick out and analyze. Ken built student and teacher pages for BAMC in the QuarkNet site and Shane and Ken made four explanatory webcasts to help students understand their tasks. A Doodle poll of the participating teachers placed the date of BAMC at April 17.

The LHC and Neutrino fellows met on Vido on March 18 and 25 to assist Shane and Ken in coping with the crisis. They gave important advice on plans for coping with the emergency and on BAMC.

Neutrino Physics

On March 31, Shane discussed progress on a NOVA-based data activity with Minnesota mentor Greg Pawloski. Greg currently has a student working to organize NOvA near and far detector data for students to analyze to better understand neutrino oscillations.

Data Activities Portfolio

To support BAMC (see above), Ken looked into converting some data activities for online and home use. He mentioned this in a communication with Jeremy Wegner, who produced a VPython simulation of Rolling with Rutherford accessible via an online IDE. Ken documented and linked this for BAMC. Jeremy had already extended Calculate the Z Mass to remote learning and documented this in the Data Portfolio; Ken linked this for BAMC as well, along with several other adaptations of data activities for remote learning. Ken then went on to make an adaptation of Muon Lifetime Part 1, which is not needed for BAMC, in order to continue making data activities available online for teachers and students at home.

Shane created a screencast to help teachers navigate through and use the sort feature within the Data Activities Portfolio. This screencast was shared in a *Friday Flyer* and has been posted within the Data Activities Portfolio as well. Shane also worked with Joel to update the introductory paragraph of the portfolio to include more information on NGSS practices.

Deborah, Ken and Shane held several scheduled phone conferences to discuss data activity documents and to plan new activities.

Increasing Diversity

Deborah, Ken, Shane and other QuarkNet STEP UP ambassadors attended one of the monthly STEP UP conference calls in March. These calls included discussions on how STEP UP lessons and *Everyday Actions* could be shared with QuarkNet fellows and teachers. Deborah has been working with Anne Kornahrens of STEP UP on making teacher notes and workshop leader notes for the STEP UP activities. “Changing the Culture” and “Careers in Physics” are complete. Work progresses on the “Women in Physics” activity.

Broader Impacts

International Collaborations – On March 2, Ken had a videoconference with Universidad de Antioquia in Colombia to discuss the CMS masterclass.

On March 5, Ken participated in a planning meeting for the African School of Fundamental Physics and Applications.

On March 9 and 23, Ken met his collaborator, Uta Bilow, on Vido. They discussed the deepening crisis and its effects on International Masterclasses (IMC). Uta and Ken were in frequent contact through the month, producing two circulars to all IMC leaders on this same subject. On March 16, they produced a third circular canceling further IMC videoconferences, in effect shutting down regular masterclasses for the season. They also planned for the upcoming May IPPOG meeting and collaborated on the IMC section of the IPPOG 2019 Annual Report.

On March 22, IPPOG announced that the May meeting would be videoconference only. This affected Spencer and Ken's plans: they will need to produce online content for it.

On March 27, APS announced that the April Meeting would switch to videoconference only. This canceled Ken's plans to have a masterclass at the meeting with Catholic University; he will still give a talk on neutrino masterclasses online for the meeting.

On March 30, the African School of Fundamental Physics and Applications along with the African Conference of Fundamental Physics and Applications, both scheduled for July 2020, were postponed, putting Ken's plans to participate as an organizer and outreach coordinator on hold.

STEAM (Science, Technology, Engineering, Art, and Math) – Shane met with artist Agnes Chavez via Skype on March 19 to continue working on future STEAM efforts. Agnes is currently working with Tagtool developer Markus Dorninger and physicists Steve Goldfarb and Nicole Lloyd-Ronning to develop modules to be used within Tagtool around topics such as gravitational waves and multi-messenger science. Shane is supporting this effort. In addition, the two continued to plan for an abbreviated *Projecting Particles*-style workshop for students at the Taos (New Mexico) Integrated School of the Arts in April. Originally, this was to be an in-person workshop, but with students now working in a distance-learning environment, the plan is to make this a virtual workshop.