

QuarkNet Staff Monthly Report
Activities of September 2023

The staff meet remotely every Tuesday to discuss QuarkNet matters in general and every Wednesday for technical issues. In addition, the staff reports the following activities:

Centers

Black Hills State University/SURF – Ken, Spencer, and Shane met with Chad Ronish via Zoom on September 6 to discuss the possibility of SURF hosting future QuarkNet national events such as Lead Teacher Camp. SURF is available to host a 2024 Lead Teacher Camp May 30-June 2.

Colorado State University – Shane met via Zoom with Cherie Bornhorst and Matthew Leach on September 19 to plan a QuarkNet keynote mini-workshop at the CO/WY AAPT Meeting in early November. Mark and Dave assisted Zach Armstrong to get his detector ready for data collection during the October 14 eclipse.

Rice University/University of Houston – Shane met via Zoom on September 15 to discuss plans for the needs assessment workshop that will take place there on December 16.

University of Illinois Chicago/Chicago State University – UIC/Chicago State had a half-day meeting on September 3. They finalized abstracts for the Moon Shadow analysis at AAPT in January 2024 and reviewed student conference registration. Mark carried out a re-analysis to calculate upper limits to shadow observation that suggests possible signals in two of the four sites. Students met with Nate Unterman on September 18 to register for the AAPT conference.

University of New Mexico – Shane met with Nate Unterman and Agnes Chavez on September 27 to discuss plans for cosmic ray detector activities at the Albuquerque Balloon Fiesta on October 12. A second detector was sent to New Mexico teachers, and Nate will bring the half-sized demo detector to the Balloon Fiesta. They discussed a special relativity measurement by teacher Kayla using the Sandia Mountain data from the workshop. Detectors in NM will be operated on the ground to correlate with other data (including data collected from a CSU detector) during the eclipse on October 14.

University of Notre Dame – Ken met with Notre Dame physicist Quynh Lan Nguyen on September 1 to discuss her plans for a gravitational wave masterclass using LIGO/VIRGO/KAGRA data. Weekly Notre Dame QuarkNet meetings resumed for the new academic year. Ken participated on September 11 and 18. Ken visited Watervliet High School to work with Caroline Fletcher on piloting a Cosmic Watch lab activity for her classes. Ken was the leader for the first three classes, and Caroline took over for the remaining two. Ken used the experience and the data taken for his presentation in the African Conference on Fundamental and Applied Physics two weeks later, adding Caroline as a co-author.

Data Activities Portfolio

Danelix Cordero-Rosario completed Spanish language versions of *The Case of the Hidden Neutrino*, *Mean Lifetime: Dice* and *Making it 'Round the Bend: Qualitative*. There are now eight activities with Spanish language versions. A new activity, *Z Mass Spreadsheet Edition*, was posted. There are now three coding activities in the portfolio. Development continues on a new activity *Angles and Dimuons*.

Cosmic Ray Studies

During September, e-Lab users made 956 cosmic ray uploads, 97 cosmic ray plots, and 8 posters. The analysis report finds 3406 analyses run (in analysis-day units) during the same period. The number of days each analysis was run are 21 Flux, 12 Lifetime, 1 Advanced Lifetime, 5 Performance, 6 Shower, and 9 Time of Flight. Mark provided help desk assistance for teachers on the following cosmic ray topics: lifetime analysis, EQUIP and PyEQUIP installation, and Rate vs. Pressure plots.

Mark has cross-checked Moon Shadow results that will be presented at AAPT. He defined a signal shape to calculate upper limits to the muon shadow search which is complicated by possible signals that are not yet compatible. Edit Peronja modified commands in the e-Lab shower module so that users can process much more eclipse data in each analysis run.

Following up on the QuarkNet interns' pyramid website work (Jensen and Brian) and improving the website, Mark and Edit retired the Glitch working area and moved all code to the e-Lab server. Jensen and another QuarkNet intern, Yashas, carried out a detailed research project: measuring the muon rate dependence on particulate matter in the atmosphere after correcting for pressure, humidity, and temperature effects. Their paper is intended for Fermilab publications; Mark will finish editing and submit it in October.

Mark continues to collect data with three detectors: 6119 for upward-muon search data, 6148 for large shower array data, and 6674 for Moon Shadow data.

Cosmic Ray Fellows met on September 28 and discussed the following: making the EQUIP upload site more obvious, participation of Centers in the 2023 eclipse in New Mexico, reports on special projects pyramid, Moon Shadow, Storm Tracking, and Radio EAS, International Cosmic Day, CMOS tracker chips, and AAPT 2024 presentations.

LHC Physics

The LHC fellows met with Ken on Zoom on September 13 to begin planning International Masterclasses and World Wide Data Day (W2D2). They continued discussion of masterclass videoconferences and became familiar with the timeline for the coming months. Also, they discussed the coming changes to the CMS masterclass.

Neutrino Physics

The Neutrino fellows met with Spencer and Shane on September 19 via Zoom to continue improving the NOvA masterclass measurement and masterclass videoconferences based on feedback from teachers and students.

International Masterclasses

Uta Bilow of TU Dresden sent the first of the International Masterclasses (IMC) Circulars on September 22 to begin the IMC 2023 ramp-up, and Ken opened registration and sent the first Memo for (W2D2) on September 29. There are thirteen W2D2 registrations, each representing a teacher and a class, as of this writing.

Broader Impacts

International Collaborations – Ken had a Zoom discussion on September 4 with Kazuo Tanaka and Miki Ohtsuka of Waseda University in Japan to discuss the common issues with the Cosmic Watch and plans for a workshop in January and a conference in March.

Ken participated in meetings of the International Organizing Committee for the African Conference on Fundamental and Applied Physics (ACP) 2023 on September 7 and 19 to finalize plans for the upcoming conference, which took place September 25-29. Ken participated in ACP 2023 in George, South Africa, in which he helped to convene two sessions and gave a presentation. On September 30, Ken and Pedro Abreu of the QuarkNet Advisory Board facilitated an ATLAS masterclass for 15 learners and 5 staff members at Inkubeko Science Centre in the township of Thembaletu, just south of George. Pedro also gave a presentation in ACP 2023 from his perspective as co-Chair of the International Particle Physics Outreach Group (IPPOG) and a physicist who has done extensive outreach in Portugal and in Portuguese-speaking countries. QuarkNet mentors Mu-Chun Chen (Irvine) and Ketevi Assamagan (Brookhaven-Stony Brook) also participated; Ketevi directs ACP.

Cosmic Rays at Pyramid – Biweekly collaboration meetings continued. Mark and Edit improved the project's new website, developed by QuarkNet interns, and released it for collaborators' suggestions. Designs for light-tight boxes and frames holding tracker planes were finalized. Assembly of detector planes has begun. Mark discussed corrections for muon position as a function of incident angle and the need to calibrate modules in the test beam for that effect.