Boston QuarkNet Center2011-2012 Annual Report

Rick Dower
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Our busy QuarkNet summer of 2011 is described in our 2010-2011 Annual Report. This Report brings us up through May of 2012 and anticipates some of our summer 2012 activities.

Minutes from the Meeting on 1 December 2011 at Roxbury Latin School:

We held a lively meeting at Roxbury Latin last night with a mix of old and new members. Newbies Joshua Copen and Abe Phelps drove from Springfield. Amanda Bragan came back for more after her introduction at the August workshop. They joined Catherine Haberkorn, Michael Hirsh, Mike Wadness, Gary Shetler, George Odell, George Alverson, and me. After introductions and dispersal of snacks, we had our usual conversations about schools and teaching. George Alverson described current efforts and recent results at the LHC – restricting the possible mass range of the Higgs boson, reported faster-than-light neutrinos, etc. Rick showed how to cleave NaCl crystals into rectangular blocks with a razor blade for an activity (attached) in which students can calculate Avogadro's number. Mike Wadness discussed the plans for the 2012 Particle Physics Masterclass and introduced our new members to the resources currently available on the web. George Odell described his Cosmos Club at North Andover that has become a regular activity for students interested in modern physics and astronomy. After setting the date for our next meeting, we departed into a chilly fall evening.

Minutes from the Meeting on 8 February 2012 at Roxbury Latin School:

We had a very enjoyable and informative meeting at Roxbury Latin last night. Joining George Alverson and me were several of our regulars: George Odell, Catherine Haberkorn, Mike Wadness, and Mike Hirsh, some recent participants: David Strasburger, David Kurtz, along with Joshua Copen and Abe Phelps from Springfield, and a new addition: Chris Perkins from Providence. The main business of the meeting was a description of the Particle Physics Masterclass to be held for students on Saturday March 17 at Northeastern.

Particle Physics Masterclass on 17 March 2012 at Northeastern University

At our annual Particle Physics Masterclass students saw alpha particle tracks in a cloud chamber, heard talks about particle characteristics and the CMS detector analysis, toured the Biophysics Labs at Northeastern, ate lunch with physicists, analyzed CMS data, and discussed results via video conference.

Minutes from the Meeting on 24 May 2012 at Roxbury Latin School:

We had a fine turnout at our meeting with 9 teachers (Patrick Corcoran, Rick Dower, Catherine Haberkorn, Mike Hamblin, Mike Hirsh, George Odell, Chris Perkins, Gary Shetler, and Mike Wadness) and two Mentors (George Alverson and Ulrich Heintz). After some conversation and a picnic supper, George Alverson presented an update of the data acquisition at the LHC. Running since April after the winter shut-down, the machine, running at increased energy (4 TeV per beam) and beam density has produced almost as much data as in all of 2011. The aim is to get

enough data before the planned shut-down in 2013 to confirm or rule out a Higgs at about 125 GeV mass. In a technology twist, George's slides were on his iPhone linked to the video projector.

Mike Wadness led a debriefing on the Particle Physics Masterclass at Northeastern in March. Teachers and their students were generally pleased with the process except for some glitches with the video conference connections. There were some comments about the tediousness of data gathering and plotting, but that was generally acknowledged as part of real science.

George Odell described his Cosmos Club activity at North Andover High School and urged others to consider forming a similar group activity at their schools to capture the interest of students in topics in modern physics.

Rick Dower showed data obtained from radioactive sources (Tl-204, Sr-90, Cs-137, Na-22) with his beta spectrograph (obtained from The Science Source in Maine). Plots show the spread of energies of the emerging beta particles that prompted Pauli to suggest the existence of the neutrino. At the request of some of the teachers, the spreadsheet containing the data and plots were sent to all center members.

Summer 2012 Activities

Mike Wadness and Rick Dower attended the QuarkNet LHC Fellows meeting at Fermilab 24-29 June to help develop and finalize activities to be presented in LHC workshops at QuarkNet centers. We want to help teachers become more familiar with the LHC machine and detectors and with data derived from the LHC. Analysis of CMS and/of ATLAS data should help teachers gain a more personal understanding of the search for results that occupies the attention of so many physicists. In addition to hearing talks from LHC experimenters at Fermilab and in Switzerland, we worked through some recent data from the CMS e-lab site and gave presentations on our results.

In response to Mike Hirsh's enthusiasm from his attendance in 2011, Rick Dower attended the Penn State workshop on Particle Astrophysics workshop 30 July – 3 August. The workshop was packed with good information and activities, including using QuarkNet cosmic ray detectors. We had talks from experimenters who were working of cosmic ray balloon flights, the Pierre Auger cosmic ray array in Argentina, the Ice Cube neutrino detector in Antarctica, and the HAWC high-energy gamma ray detector currently under construction in Mexico. The workshop was well organized and the time well spent.

Our Cosmic Ray Workshop on 7-9 August was a notable success. Chris Perkins brought his new detector kit up from Rhode Island. Mike Wadness and Mike Hirsh brought their ancient detectors from Medford and Needham, respectively, and Rick Dower made use of his hybrid detector with new scintillators and PMTs and an old DAQ (#038). George Odell from North Andover and Marge Peterson, who teaches middle school in Connecticut, rounded out the participants. Bob Peterson kept us productively busy all three days, and Ken Cecire joined us for the second and third days to offer insights and suggestions. The first day was largely devoted to assembling Chris's scintillator-PMT-PVC detectors. The photo below shows Bob Peterson holding a scintillator illuminated with a UV flashlight and fluorescing in blue light visible at the edge of the plastic scintillator.

During the 2nd and 3rd days of the workshop, we all got to use the detectors to gather data. Then we put together and presented posters based on the data. It was a great introduction to the e-Lab site and the capabilities of cosmic ray data analysis.

Onward,
Rick Dower