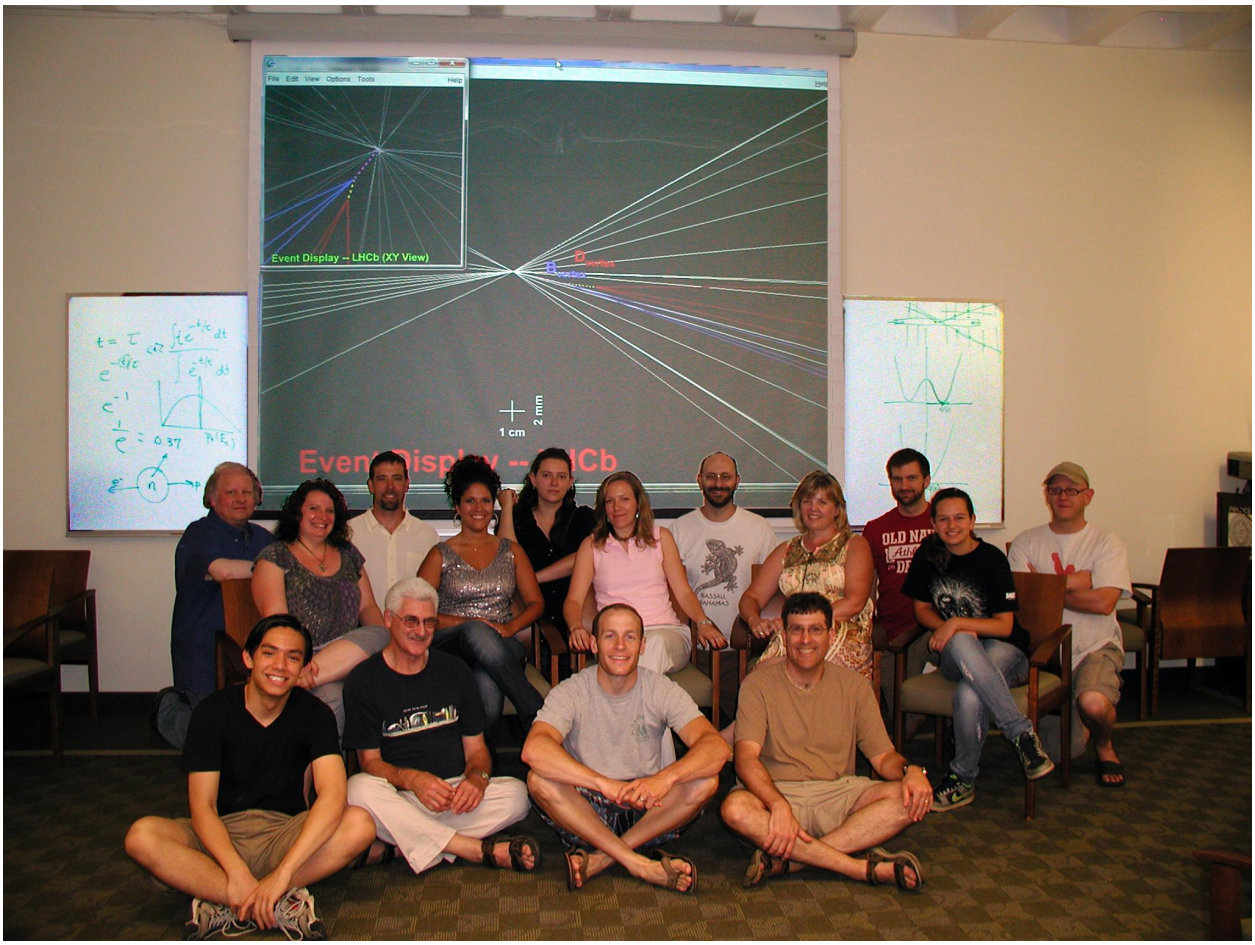
September 12, 2012

2012 Annual Report for Year 2 Quarknet program at Syracuse University

The Syracuse University particle physics group joined Quarknet in 2011, and held its year 2 institute at Syracuse University. The program was developed by Profs. Steven Blusk and Mitch Soderberg, and Research Prof. Ray Mountain. The program also benefitted by the participation of four undergraduate physics majors. The group is shown below.



Back row: Ray Mountain (SU-Res.Prof), John Lerner (Baldwinsville HS), Anna Fadeeva (SU-ug), Josh Buchman (Fayetteville-Manlius HS), Ryan Sokol (Little Falls HS), Justin Shute (Fayetteville-Manlius HS)
Middle row: Tanya Rutter (Holland Patent), Cynthia Lamphere (Port Byron HS), Alexa Perry (Fayetteville-Manlius HS), Wanda Padula (Liverpool HS), Emily Kraus (SU-ug).
Bottom row: Dylan Hsu (SU-ug), Ranald Bleakley (Weedsport HS), Michael Madden (Canandaigua HS), Steve Blusk (SU-Prof)
Not shown: Mitch Soderberg (SU-Prof), Erika Cowan (SU-ug)
[Abbreviations: SU = Syracuse Univ., ug = undergraduate, HS = high school]

Full details of the program are accessible from the web at:
http://www.phy.syr.edu/hep/HEPOutreach/QuarkNet/

The three-week institute was held from June 25 – July 13 in the Physics Department at Syracuse University. Each day, we met from 8:00 am – 3:30 pm. A light breakfast and lunch (funded by the HEP group's University research subsidy) were provided in the department in order to facilitate discussions about each day's activities amongst the entire group. The program was geared to provide both a deeper theoretical and experimental understanding of particle physics. The program had 4 main components:

1) **Teach-ins:** The first 1.5 hours each day was dedicated to a lecture series that provided a broad introduction to the many aspects of particle physics. These sessions were informal and were very interactive. The lectures are posted on the web page mentioned above, so that teachers can easily refer back to them, or use them as they see fit in their classrooms.
2) **Laboratory work:** Five experiments were developed for the teachers to work through, where each experiment featured some aspect about particle physics. The experiments were:
    a. Resonance in wires (as related to building wire chamers)
    b. Measuring the muon lifetime
    c. Gamma ray spectroscopy
    d. Analog electronics: Operational Amplifiers and Silicon Detectors
    e. Digital Electronics: Analog-to-Digitial Conversion and Data Acquisition

    Teachers worked in groups of 2-3, and rotated through each experiment. They were designed to take 2 days for each experiment. Here, the undergraduates' participation was extremely helpful. Prior to the workshop, they had gone through the experiments, and so were continually working with and engaging the teachers.

3) **Cosmic Ray Workshop:** This workshop was led by Bob Peterson from July 9-11. The teachers built two functional cosmic ray detectors, learned to use the data acquisition, and took data using the cosmic raye e-lab. The two cosmic ray detectors will start at Fayetteville Manlius High School and Weedsport High school, and will be packed up and shared among the teachers during the school year.
4) **LHCb Event Display:** On the last two days, we spent time discussing the LHCb event display that was developed during the Year 1 institute. Questions about what was being displayed were discussed, and suggestions for enhancements were put forth and implemented. We also worked on getting the software to run on all the teachers' laptops.

Several items were acquired during and following the workshop to enhance the teachers' future teaching. First, each was provided with the very good book on quantum and particle physics: "*The Quantum World: Quantum Physics for Everyone*" by Kenneth Ford. Second, during and after the workshop, we asked the teachers to reflect on the laboratory exercises, and let us know which of the items they thought would be useful to enhance lecture demonstrations or laboratory exercises. We collected their responses and with the $250 supplement per teacher, we are purchasing some the components they requested.