Department of Physics
University of Illinois at Chicago
845 West Taylor St.
Chicago, IL 60607
Tel: (312) 996-3403

Report of QuarkNet Activities at UIC during 2017-2018

The QuarkNet Program at the University of Illinois at Chicago and Chicago State provides mentoring, organization, and collaborative structure to students and teachers at ten Chicagoland high schools that host cosmic ray detectors. UIC provides detectors so that schools can carry out physics experiments based on detecting cosmic ray muons. During yearly summer week-long workshops new students are recruited and trained. Our Center is a joint UIC-CSU effort, however mentor Edmundo Garcia is on sabbatical to the NSF from CSU; therefore limited his QuarkNet activities this year. New Trier High School's freshman campus joined the Center this year with an all-women student team.

Eclipse Analysis

In 2017, the UIC Center under the lead of Cosmic Ray Fellow Nate Unterman, developed the QuarkNet activity to measure any cosmic ray flux changes during a total solar eclipse. Over thirty high school groups around the US participated. The UIC group spent fall 2017 analyzing their data. Video conferences were held to help other sites analyze their data in a consistent manner. Three UIC teachers and six students presented results in several forums at the AAPT conference in San Diego, January 2018.
https://sites.google.com/view/quarknet2017eclipse/home

UIC Eclipse group panel at AAPT

A second article in *Symmetry* described their experience, and in August 2018 students submitted an article on their eclipse measurement to *The Physics Teacher*. Adams also discussed the project and results with European Global Cosmic groups at an IPPOG meeting in Pisa, April, 2018 in an effort to increase world-wide sharing of cosmic ray outreach data.

Master Class

Teacher Tony Valsamis organized a CMS Master Class at Glenbrook North High School for three schools, including participants from a school outside of the UIC Center: Crystal Lake. Ken Cecire from Notre Dame trained three teachers at an early meeting and also visited Glenbrook on Master Class day. Students ended the day with a video conference with students from Shanghai and Honolulu.

Summer Workshop

The UIC summer workshop (June 25-29, 2018) was attended by three teachers and seven students. It was hosted at Naperville Central High School. Research groups with participants mixed from five high schools measured muon absorption as a function of overburdern by placing detectors on three separate floors. A careful normalization process was required because the effect is small. Corrections due to atmospheric pressure changes and local variations in overburden were taken into account. Participants discovered that walls created a large background and they designed additional measurements to correct for that background, including obtaining data outside.

Participants also used their data set to search for correlated muons from large air showers among the four detectors at Naperville Central plus two detectors at Fermilab.

The Fermilab neutrino campus was toured midweek. Careful attention was paid to the Minos access shaft and a high school group was formed to prepare a proposal to Fermilab to measure the cosmic ray flux in neutrino tunnel, 100 m underground, as a function of distance from the access shaft.

Workshop participants at Fermilab

During the next grant period UIC and CSU will continue to visit high school sites to mentor teachers and students and help them carry out experiments utilizing their cosmic ray detectors. The Center will host a week-long workshop next summer at UIC, as well as sponsor a winter weekend mini-workshop at a local high school.

Adams is a member of QuarkNet staff. He coordinates Cosmic Ray Teacher Fellows and continues to upgrade the e-Lab analyses.

Mark Adams
UIC Professor Emeritus of Physics

Edmundo Garcia
CSU Professor of Physics
(On leave at NSF 2018)