Fermilab/U Chicago – During the summer of 2012, the Fermilab/University of Chicago QuarkNet Group sponsored two activities: High School Student Research Collaborations, and High School Teacher Workshops.

Eight students worked with scientists at the Fermi National Accelerator Laboratory on seven different **research projects**. During the application process, these junior level high school students had a chance to read descriptions of several potential projects that were prepared by the mentor scientists. Students described their interest in these projects in response to an essay question. Based on their project interest, personal experience, and qualifications, specific research topics were proposed for each student.

The research topics included: Dark Matter, Ground Motion, the Milky Way, Optical Cavities, the Main Injector, and Pattern Recognition. Student read academic papers for many of the projects. Data analysis using various computer programs was involved on each of the projects.

A three day **workshop** for teachers, titled Beyond Human Error, was held at the end of the summer, at which there were over twenty high school teachers. Each of the high school students presented a report on their research project, and responded to questions along with their mentor scientists. The workshop also included three keynote chalk talks from scientists with their stories about scientific error and variation in measurements.

During the afternoons of the workshop, the students worked with the teachers on demonstrations of activities that could be used in high school classrooms. In addition to helping the students see how their research could be used in the classroom, it gave the teachers an opportunity to learn from the students the process by which they learn.

Several discussions were held describing how the research experiences can help all students at different levels. Teachers were very interested in the examples of how concepts that they teach are used “in a real laboratory”.

A more complete description of the results of the summer's activities is available at http://quarknet.fnal.gov/fnal-uc/quarknet-summer-research/QNET2012/.

In December, 2011, the group visited the University of Chicago Yerkes **Observatory** in Williams Bay, Wisconsin. The teachers were given a tour of the facilities, including the 90 foot dome, one of the largest ever built. They were shown astronomical instruments under construction, and allowed to look through the great 40 inch refracting telescope. They also shared in the outreach program developed at the observatory.

In February, 2012, a **master class** was held at Fermilab for a number of schools. Data samples from the CMS Experiment at CERN's Large Hadron Collider (LHC) were analyzed to compare current W/Z measurements, to the J/Ψ measurement from Masterclass 2011. Participants were excited to join the journey to study the smallest building blocks of matter.