QuarkNet Annual Report 2016

JHU Center

The JHU QuarkNet center had another successful summer, involving both high school teachers and students in its activities. The one-week teacher workshop took place from 25 July to 29 July, and the six-week student internship ran from 27 June to 5 August.

Students and teachers participated in the CMS Masterclass in late winter. Schools from across the eastern USA were involved as they used particle physics data to determine the nature of proton-proton collisions.

1. Teacher Workshop

   During the mornings, teachers and students listened to a variety of talks from professors and graduate students from the Physics & Astronomy department of JHU. See our Drupal site for details and links: https://quarknet.i2u2.org/content/2016-jhu-summer-workshop-agenda-list-talks

   Subjects included:

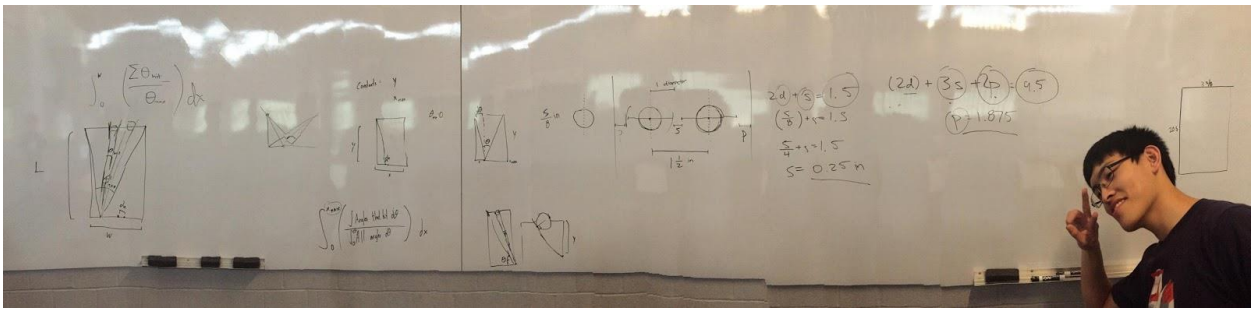
- Particle Physics
  - Mr. J. Smith – Introduction to QuarkNet
  - **Special Relativity** in a LIGO Context (Dr. Bruce **Barnett**, JHU)
  - **Resonances ("Bumps") at the LHC** (Dr. Andrei **Gritsan**, JHU)
  - **General Relativity** in a LIGO Context (Dr. Bruce **Barnett**, JHU)
  - Did LIGO Detect Dark Matter? (Dr. Marc **Kamionkowski**, JHU)
  - **Accelerator Physics** (Dr. Morris **Swartz**, JHU)
  - Modeling the **Frictional Force** (Dr. Mark **Robbins**, JHU)
  - The Role of **Muon Lifetime** in the Standard Model (Dr. Morris **Swartz**, JHU)
  - Nanotechnology (Dr. Joan **Hoffmann**, APL)
  - Status of the CLASS experiment (Dr. Joseph **Eimer**, JHU)
  - Brightly Shining **Black Holes** (Dr. Julian **Krolik**, JHU)

2. Student Research

Eight students (four from Hereford High School, along with four from Richard Montgomery High School) participated in a 6-week summer research internship beginning on 27 June and running to 5 August. After a short series of introductory activities, students were allowed to pursue research topics of their own choosing. Alongside this theoretical research, students also designed and conducted experiments with the QuarkNet cosmic ray muon detectors (CRMD): one group attempted to determine the time of flight of muons using the new tools in the cosmic ray elab. (We had a total of three CRMDs available to us during the summer).

Many of our summer students, and Jeremy Smith, using the lab area at Johns Hopkins' Physics Department (This is where we arranged our CRMDs for the summer).

Simon Liu, Jason Zhao and Jack Carlton in the midst of Rolling with Rutherford.



Jason Zhao contemplating ratios he derived for Rolling with Rutherford.

Radio astronomy played an important role this summer as students used the on-site radio telescope, programmed it to follow their directions, and then mapped the Milky Way galaxy to (1) determine the rotation rate of the various spiral arms of the galaxy and (2) hunt for dark matter in the galaxy.

Site for student projects: https://quarknet.i2u2.org/content/jhu-quarknet-summer-2016-summer-student-research