Johns Hopkins University Physics & Astronomy Quarknet Annual Report

Masterclass

On March 10, 6 teachers brought 34 students to JHU to participate in the annual WZH Masterclass project. During the morning, lead teacher Jeremy Smith gave a talk summarizing some basic principles of particle physics and the structure of the CMS detector; following his presentation, mentor professor Dr. Morris Swartz explained the event display software used in the iSpy website, and how to interpret the characteristic signatures of W and Z bosons. After a lunch break, students broke into small groups of 2-3 and analyzed a set of 100 events, categorizing each as a W or Z candidate – and in one or two cases, a potential Higgs candidate – and populating an online spreadsheet with the masses of all candidates with a neutral charge, as well as the relative frequency of W^+ vs. W^- bosons. Following the data analysis, Dr. Swartz led a brief discussion of the results and their implications, and the students joined several other centers in a videoconference to share their results and ask questions of each other. Both students and teachers reacted positively to the event, and we look forward to participating again next year.

Teacher Workshop

The JHU Experimental Particle Physics Group sponsored its annual QuarkNet Workshop in the Bloomberg Center the week of July 23 through July 27. This was the 17th year JHU has been part of the national QuarkNet program. This year's workshop maintained its size at 18 teachers, Two of the teachers were new to the workshop and sixteen had been in the program before. As is standard from past years, the teachers came from a wide variety of backgrounds. There were both male and female teachers representing Baltimore City and non-Baltimore City schools, public and private schools, single sex and regular schools, secular and religious schools, as well as schools from both Maryland and Pennsylvania.

Teacher Workshop: AM

The workshop format was talks in the morning and "lab" in the afternoon. From the particle physics group, Petar Maksimovic gave a talk on the basics of quantum mechanics, to help some of the new teachers feel more comfortable with the topics covered by other professors. Andrei Gritsan gave a presentation on the intersection of particle physics and cosmology. From the cosmology group, Mark Kamionkowski provided an update on some recent cosmology. Jason Kalirai of the Hubble Space Telescope Science Institute gave a presentation on the James Webb Space Telescope. Sabine Stanley spoke about planetary science. Emmanuele Berti gave a talk on gravitational radiation. Quarknet Fellow Marla Glover gave a 2-day workshop on science projects with LIGO seismic data. Nima Arkani-Hamed spoke about interesting scales of the universe. Jeremy Smith, one of the lead teachers of the JHU group, gave the first talk of the week, welcoming new teachers to the group and providing a broad overview of what QuarkNet is, and some of the historical topics leading to the discovery of the Standard Model.

Teacher Workshop: PM

The afternoon time was less structured than it has been in some past summers and focused on several pedagogical activities for 2 days and on the LIGO environmental data workshop lead by Marla Glover for 2 days.

Mentor: Morris Swartz

Lead Teachers: Jeremy Smith & Kevin Martz