

# Overview of UCR Quarknet Activities for 2011–12 Annual Report

**Web page:** <http://faculty.ucr.edu/~ellison/Quarknet/>

## Masterclass

Students from three high schools attended: San Jacinto HS, Riverside Preparatory Academy, and Lakeside HS. It was the first time for Lakeside. For the first time, we needed to limit attendance. There were around 80 students who wanted to come but we could only accept 60 due to finite classroom size and number of instructors. There were introductory lectures from Drs. Simani, Long, Clare, and Gary. The lectures were on particle physics, detectors, CMS, and on how to do the exercises. We analyzed LHC data. The students used ATLAS data and tried to identify events with a Z boson that decays through  $Z \rightarrow e^+e^-$  or  $Z \rightarrow \mu^+\mu^-$ . The students were broken into groups of 2-3 students. Each group was given a different sample of 100 events to examine. They clicked on the candidate electron or muon tracks. The invariant mass of track pairs was automatically calculated and a histogram of the invariant mass values was generated. We collected all the results from the class into one histogram.

We found a clear peak from the Z and were able to evaluate the background from the combinatorial background. Besides the Z peak, there was a small peak at 1000 GeV because there were fake "Z-prime" events that were planted in the sample. This allowed us to make the point on one way the LHC searches for new physics. There were also peaks at lower invariant mass values, from Upsilon and J/Psi meson decays. The following morning the students returned to UCR and we held a videoconference with CERN moderators. Besides UCR, high school classes from Portugal, France, and Slovakia, all of whom had done the same exercises, participated in the videoconference. During the videoconference, we compared results and asked questions, both to the moderators and European students. The kids enjoyed the Masterclass program very much. At the end, we gave them UCR Physics & Astronomy tee shirts and they took a tour of campus.

## CosmicRay Detectors

We now have six detectors in local schools and teachers have been active in using them. We held a workshop at UCR on July 16–18 that was attended by nine teachers, all of whom are now active with CRDs. On the first day Prof. Ellison gave a presentation on Cosmic Rays and we constructed 3 planes of a new CRD. We did exercises to familiarize the teachers with the equipment and with plateauing the counters and the teachers collected data overnight. On the second day we did more hands-on activities with the detectors and the DAQ software, and started analyzing data with eLab. The third day was devoted to more data analysis, discussing the various projects that could be done with the CRDs and generally answering the teachers' questions. The teachers will be active in doing projects with the CRDs and we plan to have discussions and comparisons of results among the different schools via videoconference hookups between the different schools and UCR. Our most experienced

teacher is Mark Bonnard (San Jacinto High School) and he has agreed to be the “lead teacher”, helping with coordination and with answering questions from the other schools.

**Active Teachers:**

#	2012 Status	Last Name	First Name	School Name
1	active	Bergen	Doloumar	Santiago High School, Corona
2	active	Bonnard	Mark	Hemet High School, Hemet
3	active	Calderon	Martin	Adelanto High School, Victorville
4	active	Gifford	John	Poly High School, Riverside
5	active	Lilly	Deborah	Aveson Global Leadership Academy, Pasadena
6	active	Matthews	Sean	West Valley High School, Hemet
7	active	Patterson	Rudolph	Silverado High School, Victorville
8	active	Schurr	Deborah	Ontario High School, Ontario
9	active	Schurr	Randall	Carter High School, Rialto