Annual Report
Virtual QuarkNet
2017-2018

Virtual QuarkNet is a group of teachers who are generally some distance from a research facility. As a consequence, the group meets monthly by video conference (through CERN Vidyo) during the school year and at a physical site once each summer. During the 2017-18 year there were three mentors and 14 teachers. That included two lead-teachers and 4 new members who joined during the year. (Attendance details below.) During the school year the group met on nine Sunday evenings (8PM Eastern) with participation ranging from 10 to 14 with an average of 12.3. At the end of each video conference the group chose by consensus the best date for the following meeting.

Typically each video conference included some "social time" with participants sharing events in their lives and at school. Comparing weather was also common each evening. (One participant teaches in Shanghai so his meeting time was Monday morning.) September's discussion included the previous summer's solar eclipse and what each did and observed. One mentor made a presentation on condensed matter in October. As typical of most gatherings, discussion in November included the latest news from the LHC, other physics discoveries and explanations as relevant by the mentors. As in many of the conferences, participants shared teaching issues and innovative things where were trying with their classes, including "laboratory activities' and testing. January's discussions included results and projects involving the QuarkNet cosmic ray detectors which a number of the participants have. As sometimes discussed on other Sunday's the February discussion included what had been learned at other teacher workshops, particularly the encouragement of women in physics. By March summer workshop plans were being proposed and considered. Many of the teachers had participated in MasterClass. One of the teachers shared cosmic ray data obtained during a major storm showing a sizable increase in cosmic rays when the air pressure was lower. (As typical, that is available in the cosmic ray e-lab.) April included a detailed presentation of the LHC and the detectors. Besides summer workshop plans being finalized in May, one of the mentors presented a robot he is developing to automate testing

of large numbers of optic connections which will need to function following the next equipment update of the CMS detector.

The virtual group has made a practice to choosing a location for the summer workshop where participants can increase their understanding of a significant aspect of modern physics. The 2.5 day 2018 workshop was planned for Portland, Oregon. Five teachers and two mentors participated. One day was spent traveling to Hanford, Washington to visit and learn more about the LIGO investigation and findings. Much of the rest of the workshop was spent in the facilities of Vernier Software, Beaverton, Oregon, investigating the possibility of teachers and perhaps eventually students actually looking at both simulated and real LIGO gravity wave data (instead of the background seismic noise data currently available using the QuarkNet LIGO e-lab). The goal was to try to calculate the chirp masses and astronomical distances of collapsing binary star systems. Dave Vernier generously provided our group a tour and shared his facilities and time.

Virtual QuarkNet 2017-18 Participation

participants	17 Sept 2017	29 Oct 1	19 Nov 1	17 Dec 1	14 Jan 1	18 Feb 1	18 Mar 1	22 Apr 1	20 May 1
Danielle	x	x	x	x	x	x	x		x
Dan	x		x	x	x	x	x	x	x
Antonio	x	x	x	x	x	x	x	x	x
Mike	x	x	x	x			x	x	x
Dave	x	x	x	x	x	x	x	x	x
Joel	x	x	x		x	x	x		
Kelly	x	x	x				x	x	
Marteen	x			x			x	x	thunder
Charlie	x	x	x	x	x	x	x	x	
Nicole	x	x	x	x	x		x	x	x
Debbie	x	x	x	x	x	x	x	x	
Darwin	x	x	x	x	x	x	x	x	x
Jim	x	x	x	x	x	x	x		x
Kathy	x	x	x	x	x	x			

participants	17 Sept 2017	29 Oct 1	19 Nov 1	17 Dec 1	14 Jan 1	18 Feb 1	18 Mar 1	22 Apr 1	20 May 1
Brooke		x			x				
Joe			x						
Megan					x		x	x	x
# online	14	13	14	12	13	10	14	11	10
								Average:	12.3