

# The University of Iowa

## Quarknet 2017 Summer Institute

### **Principal Investigator:**

Dr. Yasar Onell

### **Associate Professors:**

Dr. Jane Nachman, James Wetzel

### **Teacher\Mentors:**

Peter G. Bruecken, Michael Grannen and Moira Truesdell

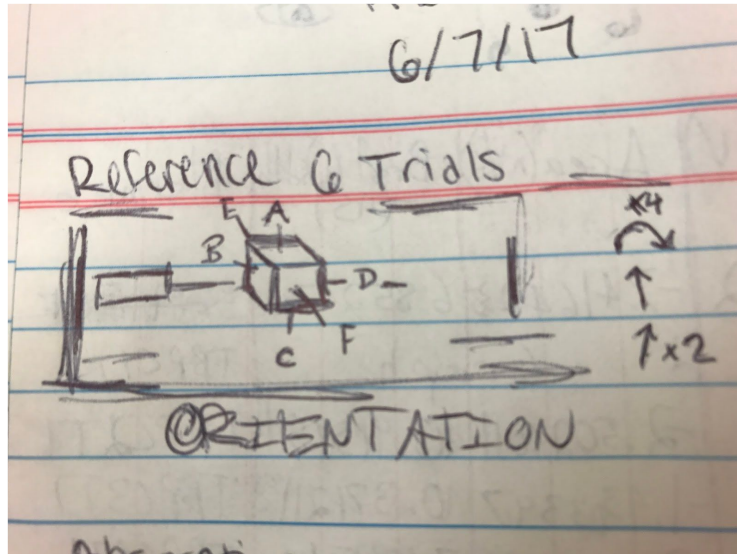
### **Students:**

Mary Grace Armbrust, Adam Edwards, Andrew Haffarnan, Max Herrmann, Roger Witmer, and Joshua Turner

During the summer of 2017, The University of Iowa involved six students from Bettendorf High School and 3 teachers in research activities. The work was directed by our Principal investigator, Dr. Yasar Onel and mentored by three of the teachers, Peter Bruecken, Michael Grannen and Moira Truesdell. The summer activities focused on three projects: Testing the effect of UV exposure on scintillating materials, [muon telescope purpose], and analyzing CERN data to find Z' particles. [These projects were extensions from the 2016 summer work.]

### **Activity 1: Scintillating cubes:**

One of our responsibilities was to test various cubes of scintillating material that had been exposed to a radiation source. To start off, we tested some cubes provided to us by the University of Iowa to determine whether the orientation of the cube changed the amount of transmission and absorption. We determined arbitrarily that a significant difference would be a 10% difference between each of the orientations, which there was not, so we decided that putting the cubes in different orientations would not cause significant enough changes



We tested the absorption and transmission of the cubes with a xenon lamp to establish a baseline, then exposed the cubes to ultraviolet light to further test a hypothesis of Dr. Wetzel's theorizing that exposure to UV light will help scintillating materials recover faster from radiation than if they were left to recover on their own. After exposing the cubes to the UV light, we tested their absorption and transmission again to determine if there was a measurable difference in the rate at which the cubes were "healing." Our raw data was given to James Wetzel for analysis and the later data was collected by and compiled by other students working with him.

### **Activity 2: Cosmic Ray Detector:**

Another of our responsibilities was to operate and monitor a cosmic ray detector. Every day we started the detector using the PUTTY application. We measured shower data as well as flux data on a daily basis, starting up testing when we arrive in the morning and ending by 15:00 when we leave.

### **Activity 3: CERN VM data analysis:**

We installed Ubuntu and the Cern VM, and created an initial scatter plot based off of a photon analysis. Several components had to be debugged but the final scatterplot was a success. Initially working with two muons and a photon, we debugged and revised a template analysis to suit our needs. From then on we attempted to search for  $Z'$ , a new particle, which with we were unsuccessful due to time constraints. The code that was written for the virtual machine can be found in the folder called "python"



