

What: QuarkNet Data Camp

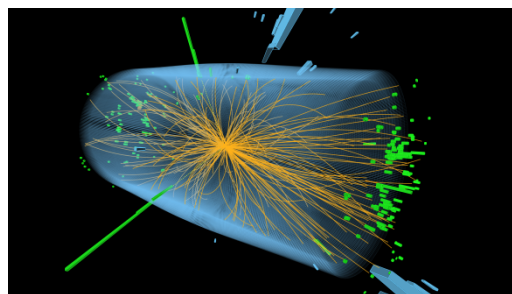
Where: Fermilab, in Batavia IL

When: 9-14 July 2023

Cost: \$0 - All flight, hotel and parking/driving expenses paid, plus \$600 stipend and \$48 per diem.

Data Camp is designed to be an introductory experience for teachers of physics and physical science who have little to no experience with the world of high energy particle physics, and who are looking for a kickstart. We have tried to make this different from a traditional teacher workshop by putting emphasis on an authentic data analysis experience, in which the teachers get to play the student role by learning a challenging topic they initially know very little about!

In the beginning of the week, teachers will be given a real dataset from the Large Hadron Collider (LHC) experiment, and by working collaboratively in small groups, will follow in the footsteps of the greats by using these data to determine the mass of particles produced during LHC proton-proton collisions and detected by the Compact Muon Solenoid detector (CMS). Successful completion of this phase of the workshop culminates in each group presenting and explaining a plot of the invariant mass of a particular particle from a particular decay mode (e.g. mass of the  $J/\psi$  meson based on decays to electron and positron). Teachers will also be able to visually interpret event display plots similar to those used by particle physicists at CERN, as depicted at right.



Following this exercise, teachers will be given an opportunity to explore various classroom activities existing in the QuarkNet Data Portfolio (<https://quarknet.i2u2.org/data-portfolio>) that are intended to help teachers incorporate high-energy physics concepts into their everyday lessons. Many of these activities utilize real data from CMS or other high-energy physics experiments such as ATLAS, LIGO, TOTEM and the QuarkNet cosmic ray detectors. Successful completion of this phase of the workshop will result in teachers developing an implementation plan that they can choose to try out with their students the following year. Up to 3 graduate credits can be earned for teachers who (a) register for the graduate class at U. St. Francis and (b) submit their formal implementation plan along with adaptations unique to their school or school district. All participants will gain access to a document certifying that the workshop time is eligible for PD credit in the state of Illinois, which other school districts may also be willing to honor.

Throughout the week, teachers will also have the opportunity to take various tours of the Fermilab campus, including such destinations as the LINAC tunnel, MINOS experiment, the Neutrino Campus, the LHC remote operations center, and the Silicon Detector Facility. Teachers will also get to hear talks from both theoretical and experimental physicists who work on various experiments at Fermilab. However, teachers need to understand that tours and guest speakers are not the main goals and will receive the lowest amount of priority and time.