2023 Coding Camp 1 Agenda

Where: Zoom (links in the agenda below)
When: Monday, June 26 - Friday, June 30, times (times below)
Stipend: $600 ($120/day for 5 days) plus $250 reimbursement for technology (see below)

We'll post agenda and details here as they develop. Looking forward to seeing you all.
- Adam & Danelix

Time Zone	Session 1	Break	Session 2
Eastern & Atlantic	10am-2pm	2-4pm	4-6pm
Central	9am-1pm	1-3pm	3-5pm
Mountain	8am-noon	noon-2pm	2-4pm
Pacific	7am-11am	11am-1pm	1-3pm
Hawaii	(don't even)	…	10am-12pm

QuarkNet Coding Fellows

Danelix Cordero-Rosario cdanelix@hotmail.com, Univ of Puerto Rico Mayaguez
Chris Hatten, Rice/Houston
Tracie Schroeder, Kansas
Kayla Mitchell, New Mexico
Adam LaMee adamlamee@gmail.com, Lead Coding Fellow, Amer. Physical Soc.

Campers

Name	QuarkNet Center
Adam Jenkins	Hawai'i
Anastasia Perry	Fermilab
Bree Oatman	Black Hills State University
Chelsea Johnson Muir	Florida State
Emily Gwin	Florida State
Eric Apfel	Mid-Florida
Felix Nieves	UPRM
Gary Johnson	Rice University
Ian Finnerty	Mid-Florida

Janet Kahn	William and Mary/GMU
José Pérez Sanabria	UPRM
Katherine Boutin	Florida State
Keith Marshall	Catholic University of America
Lydia Santiago	UPRM
Marc Baron	U of Pennsylvania
Marteen Nolan	Virtual
Marvin Davis	Johns Hopkins
Migda Ruiz	UPRM
Monica Lopez De Victoria	UPRM
Roberto L. Diaz Diaz	UPRM
Sara Kate May	Hawai'i
Tiffany Madison	Chicago
Tseveldorj Oyuntugs	U of Washington
Vandana Raghuvanshi	UChicago

Before Camp

- Tech stuff
    - You'll need a device with a mic and camera that can run Zoom
    - You'll also need a desktop, laptop, or Chromebook for the coding activities logged into a Google account that isn't linked to your school account (there may be school restrictions that cause problems). Test your setup by doing some (or all) of this Intro coding activity. If you have trouble with that, let us know and we'll get you sorted out.
    - Tablets and iPads aren't great for the coding activities we're doing. If you need, you could Zoom with a tablet and do the coding parts on another computer (without mic & camera).
    - If you'd like to buy a better router, modem, headphones, cheap Chromebook, upgraded laptop, or other tech to help you participate, we'll reimburse **up to $250** of approved purchases to help you work virtually. Save your receipts to submit at the end of camp.
- Studying
    - You do not need to read or study before the camp. But if you're itching to get started, see the "Resources" section at the end of this page for ways to spend your time while you're avoiding other stuff around the house.
- Money and graduate credit
    - $600 stipend for completing the week
    - $250 tech reimbursement (see above)

    - (optional) 3 graduate-level science education course credit through University of St. Francis:
        - Tuition is $100 per credit hour ($300 total)
        - Register here for REAL 695 L QuarkNet Coding I (3 credit hours)
    - Even if you don't enroll in the graduate course, you'll still receive a certificate for 30 contact hours.
- Questions? Email Adam at adamlamee@gmail.com

Workshop Goals

1. Review and reteach core concepts of particle physics, such as the framework of the Standard Model, the anatomy of a particle accelerator and detector, and the methods for calculating invariant mass from 4-vector data.
2. Review and apply basic aspects of computer programming in Python, such as conditionals, math functions and plotting, and file manipulation.
3. Use simple programming tools to analyze large datasets generated from the CMS experiment in the 2010 and 2011 runs, and run analyses of these data. Generate conclusions about these analyses that include both calculations and plots (e.g. of invariant or transverse mass).
4. Search for new scientific datasets available online and write code to perform analyses of these new data.
5. Design a series of code-centered activities that either add onto existing units in a high school physics course, or replace an already existing activity; create a plan for implementation of these activities.

QuarkNet Enduring Understandings

1. Claims are made based on data that constitute the evidence for the claim.
2. Particle physicists use conservation of energy and momentum to discover the mass of fundamental particles.
3. Indirect evidence provides data to study phenomena that cannot be directly observed.
4. Scientists continuously check the performance of their instruments by performing calibration runs, using particles with well-known characteristics.
5. Data can be analyzed more effectively when properly organized; charts and histograms provide methods of finding patterns in large data sets.
6. Data can be used to develop models based on patterns in the data.
7. Physicists use models to make predictions about and explain natural phenomena.
8. Particle decays are probabilistic for any one particle.
9. Physicists must identify and subtract "noisy" background events in order to identify the "signal."
10. Well-understood particle properties such as charge, mass, and spin provide data to calibrate detectors.
11. The Standard Model provides a framework for our understanding of matter.

12. Research questions, experiments and models are formed and refined by observed patterns in large data sets.

Agenda

Monday, June 26

Session 1 Zoom Link	(15 min) Welcome (w/ Danelix) ● stipends, tech reimbursement, graduate course credit ● plan for the week: student hat first, then teacher hat (30 min) Norms discussion and activity (w/ Danelix) ● introductions ● Hopes and Fears survey ● In breakout rooms: ○ STEP-UP poster from APS STEP-UP ○ Fermilab norms poster ○ Which poster items resonate with what you're doing this week? ○ Which poster would you hang in your classroom? ● Hopes and fears survey responses BREAK (5min) (10 min) Our philosophy re:coding (w/ Chris) ● Pair Programming (2 hrs) Driver/navigator time ● Intro to coding ● Probability and Histograms using dice ● Modeling and graphing projectiles with air resistance ● If you finish early, start the muon mass activity. If not, we'll do that in the next session.
Session 2 Zoom Link	(30 min) Guest speaker @ 4:15 PM EDT ● Farrah Medi-Simpson, PhD student at Brown University (30 min) Particle Physics review (w/ Chris) (1 hr) More driver navigator time: ● Calculate the mass of a muon using CMS data ● Big datasets: the 100,000 brightest stars in the Milky Way (15 min) All hands meeting (w/ Danelix) ● A web search can be the best programming help ● Other announcements?

	● Cool particle physics merch ○ Oregon State Physicists for Inclusion in Science shirts ○ Muon Collider shirts, stickers, and mugs ● Daily feedback survey

Tuesday, June 27

Session 1 Zoom Link	(60 min) All Hands meeting ● Successes / challenges from yesterday's notebooks ● New groups ○ Choose a group based on which notebook you would like to work on. Try to limit to around 3 people per room ○ Keep using the driver/navigator roles in your breakout rooms (30 min) Guest speaker @ 11:00 AM EDT ● Harrison Prosper (FSU), experimentalist at CMS (30 min) Share out intro and probability notebook (1 hrs) Calculate the mass of a muon using CMS data If you finish early can start work Big CMS dataset analysis ● When you are ready! ● take breaks as needed ● swap driver/navigator periodically ● ask us for help if you get stuck (15 min) All hands ● Take a look at each group's notebook ● What patterns did you find? ● Any HEP questions?
Session 2 Zoom Link	(30 min) Share out muon mass notebook (1.5 hrs) CMS analysis working time ● Finish creating an invariant mass plot for you particle ● Discuss these follow-up questions in your group ● How would you use your mass plot to tell someone about your particle? If you finish the notebooks, start thinking about how you might incorporate Colab into your courses (10 min) All Hands Meeting ● Daily feedback survey ● Share Document

Wednesday, June 28

Session 1 Zoom Link	(30 min) All Hands ● Thoughts from yesterday ○ BlackinPhysics.org ○ Why are there bison on the muon collider shirts?? ● Do you 3D print? ○ CMS 3D printed models on Thingiverse here ○ CERN S'cool lab and their library of 3D printed models ● Money! ○ Anne Zakas needs your SSN, call her at 574-631-2789 and leave a message. ○ For up to $250 reimbursement, email Anne Zakas (zakas.1@nd.edu) with receipts showing payment was made. ○ Graduate credit info (in the afternoon Adam explain) ■ Register here for REAL 695 L QuarkNet Coding I (3 credit hours) ○ How to keep reinforcing norms throughout the year? ○ Other cool things discovered ■ data.head() ← what's the significance of "data" ○ Items 1 & 2 on the 2023 workshop must-do items page (30 min) Share out muon mass notebook (1hr) Big CMS dataset analysis ● Work in Big CMS dataset analysis ● When you are ready! ● take breaks as needed ● swap driver/navigator periodically ● ask us for help if you get stuck (1hrs) CMS analysis working time ● Finish creating an invariant mass plot for you particle ● Discuss these follow-up questions in your group ● How would you use your mass plot to tell someone about your particle? If you finish the notebooks, start thinking about how you might incorporate Colab into your courses
Session 2 Zoom Link	(20 min) Keep generating 'teacher hat' ideas ● Chat from the AM session ● Briefly share and discuss your group's results ● Discuss the follow-up questions (Jeremy)

	(30 min) All Hands ● Share results ● Shift to Teacher Hat! ● What most schools don't teach video ● Learn plate tectonics by inquiry? Try this notebook. ● Implementation advice on CODINGinK12.org ● Brainstorm lesson ideas (30min) Preliminary data investigation ● Choose a data set to investigate and create a notebook (by Thursday AM) that all participants can run and understand. ● Some interesting CMS-related code: ○ Tom McCauley's Z filter to pull events containing 2 muons ○ Particle Physics Playground ● Lots of datasets at the UCI Machine Learning repository ● Use lab data from you class or collect data with your phone with PhyPhox ● Library of helpful coding tips ● Adam's CODINGinK12.org (15 min) Daily feedback survey ● Share Documet

Thursday, June 29

Session 1 Zoom Link	(1 hr) All Hands ● Thoughts from yesterday ● Teacher opportunities ○ National STEM Scholars ○ Engineering Summer Prog. for Teachers ○ PICUP collaboration ○ DataJam ● Introduce your pets ● BlackInPhysics.org and the essay series in Physics Today we all should read ● CERN Open Data (30 min) Karolina Wresilo, neutrino PhD student from Univ. of Cambridge (1 hr) Teacher Hat working time (30 min) Share your work so far ● (add 'view' link from each camper's notebook)
Session 2 Zoom Link	(15 min) All Hands

	• Teacher opportunities
	  ○ National STEM Scholars
	  ○ Engineering Summer Prog. for Teachers
	  ○ PICUP collaboration
	  ○ DataJam
	• Introduce your pets
	• BlackInPhysics.org and the essay series in Physics Today we all should read
	• CERN Open Data
	
	• Share your notebook
	
	Repositories resources
	
	• CODINGinK12.org
	• CODINGinK12.org GIBHUB_data
	
	(1.5 hrs) Teacher Hat work time: continue developing and refining new notebook
	• Arduino
	• Mobile app data collection (like PhyPhox)
	• More particle physics
	• Data for social good, locally-relevant data
	• Cosmics
	• Astronomy
	• Computational modeling
	• Hangout room
	• Quiet room
	
	Teacher Hat mode
	• work individually or in 2s or 3s
	• develop a plan for implementation with your students
	• use whatever format or structure you'd like
	
	(15 min) Daily feedback survey

Friday, June 30

Session 1 Zoom Link	(15 min) All Hands ● Thoughts from yesterday ● Money! ○ **For stipend**: Anne Zakas needs your SSN. You can leave a secure voicemail at 574-631-2789. ○ **For reimbursement**: send receipts showing payment to Anne Zakas (zakas.1@nd.edu) and she'll send a check for up to $250 ● Items 1 & 2 on the 2023 workshop must-do items page ● group photo later this AM ● Graduate course: register by today ○ Register here for REAL 695 L QuarkNet Coding I (3 credit hours) ● Ideas for optional breakouts later ○ any ideas? (anytime this AM) QuarkNet annual teacher survey (15-20 min) ● only do this once per year ● skip if you did this in a QuarkNet workshop already since June 1, 2023 (1.5 hrs min) Continue working on implementation plan ● A good place to include your implementation plan is in your coding notebook. ● Be prepared to have others look at your implementation plan and coding activity at the beginning of Session 2. ● Add a link to your implementation plan to the sharing spreadsheet.
Session 2 Zoom Link	(10 sec) Group photo (40 min) Share plans for implementation in groups of 4 ● Assign a **timekeeper** since this timeline is tight ● 5 minutes of each camper "Driving" one notebook; 5 minutes of feedback/questions ● Participate as a student might. The author can make their own notes with comments/feedback. ● Briefly decide upon ONE activity (of the four) that you want to "showcase" later. (45 min) Coding Activity Showcase ● (3 min each) Showcasers will screen share, briefly summarize their lesson, and mention some of the feedback received during the small group session ● Sharing spreadsheet

After Camp

- Here's the group photo!
- For professional development credit, you can download this certificate to add your name and give it to your school or district.

Resources

Learning to code

- CODE.org has TONS of great stuff for teachers and students
- W3Schools.org has great, free tutorials on Python, HTML, Java and more
- Python for Everybody (pdf) book
- Python Programming: An Introduction to Computer Science by John M. Zelle
- EDX.org online courses
- Chris Orban's Let's Code physics simulation activities and HS coding page on Compadre
- PICUP collaboration of activities submitted by other teachers

Data Science

- PBS documentary Coded Bias about algorithmic biases and their societal effects
- Chris Albon's Pandas tutorials (see the *Data Wrangling* section)
- Jake Vanderplas' Data Science Handbook
- Adam's CODINGinK12.org science coding activities
- Function to run on a Pandas DataFrame (like getting columns names or seeing unique values) and some Pandas statistical functions
- Some Numpy functions
- Some Pyplot functions
- Matplotlib cheat sheets
- Invisible Women: Data Bias in a World Designed for Men by Caroline Criado Perez

Physics

- Disordered Cosmos: Dark Matter, Spacetime, & Dreams Deferred by Dr. Chanda Prescod-Weinstein
- Reading recommendations page
- *Quantum Diaries* blog
- PhyPhox mobile app to collect, plot, and export raw data from Apple and Android mobile devices. And it's free.
- Particle Physics Data Group (PDG): for example, the page on the J/ψ.
- CERN OpenData project
- Teaching Relativity in Week 1 by E. R. Huggins