OSU QuarkNet Workshop, July 18-21

(Physical Sciences 147)

Objectives for 18-19 July

Participating teachers will:

- Apply physics principles to reduce or explain the observations in data investigations.
- Examine simulated and experimental data. Identify patterns within the data and consider the causes of those patterns.
- Create, organize and interpret data plots; make claims based on evidence and provide explanations; identify data limitations.
- Develop a plan for taking students from their current level of data use to subsequent levels using activities and/or ideas from the workshop.

QuarkNET Agenda TinyURL: https://tinyurl.com/OSUQN2022

Monday, July 18th - Morning Session

9:00 Opening & Registration

- Welcome & introductions
- Registration (https://forms.gle/VeuyjybWkgMvCUji6) and create/login to Google account
- Update QuarkNet account (https://quarknet.org/document/update-your-profile-quarknet-site)

9:30 Working together

- Norms: APS STEP UP poster & Fermilab norms poster
- Video: Pair programming how-to (YouTube) (Amara w/Sp subtitles)
- Video: What Most Schools Don't Teach
- A look at the Data Activities Portfolio

10:00 Coding activities (GitHub) (Colab Survival Guide) (MikeP's Sample Code Blocks)

- Introduction to Jupyter
  - Skills: run, edit, & save a notebook
- Probability
  - Task: Simulate flipping a coin and make a histogram of the number of heads for each trial.
  - Skills: generate random numbers, create and format a histogram
- Position graphs
  - Task: analyze Position graphs
  - Skills: modify a loop, define a function, format a plot

11:45 All Hands Meeting

- Share observations, challenges
- How do you think your students would handle these tasks?

12:00 Break

- Lunch
- Create/update your Quarknet.org account

Monday, July 18th - Afternoon Session

13:15 Special Topic - collecting data from the Smartphone

With G accel data set
WithOut G accel data set
James & Joe Cool Plot

13:45 Try another coding activity

- Velocity graphs
  - Task: Analyze Velocity graphs
  - Skills: modify a loop, define a function, format a plot
- Projectile in Air
  - Task: Model the motion of a projectile in air
  - Skills: modify a loop, define a function, format a plot
  - James & Joe - Cool Look at Tesla in the Air
- Quakes
  - Task: Identify patterns in global seismic activity
  - Skills: read in a large data set from the web, visualize complex data
- Global Temperature
  - Task: Describe the differences between land and water on temperature
  - Skills: read in a large data set from the web, visualize complex data
- Tides
  - Task: Identify patterns in tidal height over time
  - Skills: read in a large data set from the web, visualize complex data, manipulate time series data

Chris's Stars Notebook
Motion of a pendulum
Charlie's Gravitational and Electric Fields Program
Here is the source of a pennies mass lab
Python in Biology
Github in Biology
Getting Data from Google Sheets - the penny lab is near the bottom
This site from CERN has a great notebook view of analyzing CERN data
Datasaurus Dozen resource code, etc

14:30 Special Topic: Lab Data Analysis Using Python Notebooks

Slides
Notebook: Lab Data Linearization Analysis in Python
Google Drive Folder: "Dry Lab" Spreadsheet & Python Linearization Activity
Notebook: Comparison of 2 Mean Values from 2 Measurement Sets

15:00 Introduction to Muon Mass Notebook

- Short introduction to Muon Mass notebook
- Muon mass
    - Task: measure the invariant mass of a muon
    - Skills: calculate invariant mass given its 4-vector (energy and x/y/z-momentum), make a mass plot

15:45 All hands meeting

- Share observations, challenges
- How do you think your students would handle these tasks?

16:00 End of day

Tuesday, July 19th - Morning Session

9:00 Welcome back

- Recap from yesterday
- What stood out? Any new thoughts?

9:15 Change from student hat → teacher hat!

- Work Time Outline (Today, this morning and Tomorrow Morning)
- Where might these (or your own) coding activities fit into your course?
- Develop a coding activity and integrate it into your course plan.
    - See CODINGinK12.org site and the UCI Machine Learning repository for data sets
    - Coding Fellows Colab Survival Guide
    - Mike P's Sample Code Blocks Document
    - embedding an image from your Google Drive (source):
        - In a text cell, embed an image with: ![alt text label](URL-to-image)
        - Original URL: https://drive.google.com/file/d/0B6wwyazyzml-OGQ3VUo0Z2thdmc/view
        - Edit the URL to look like this: https://drive.google.com/uc?export=view&id=0B6wwyazyzml-OGQ3VUo0Z2thdmc
    - Opening a Google Sheet in Colab
    - Superscript example: In a text cell:
        - word ^{exponent} will display as word exponent
    - This site can be used to create equations in Markdown: https://latexeditor.lagrida.com/
    - Here is a project I wrote a couple of years ago with a statement about project expectations.
- Create an implementation plan.
    - The format should be whatever is useful to you. How do you sketch out your lessons? Do you use a form from your school or district?

11:30 All Hands Check In

12:00 Break

- Lunch

Tuesday, July 19th - Afternoon Session

13:30 Continue working on implementation plan

- Get help on coding issues
- Finish your coding activity and drafting an implementation plan

14:30 Share out

- Teachers take turns (5 min each) sharing your ideas for how coding might make it into your classroom. If your Colab notebook is ready for others to try out,
    - Click the Share" button in the top right of the Colab notebook.
    - Copy the link to give others **view-only** access.
    - Send that link to michael.plucinski@gmail.com and we'll post in on the agenda
- The Sharing!
    - James M - Friction
    - Ashley A - Pie Charts - Teacher Version
        - Ashley A - Pie Charts - Student Version
    - Kevin - Data Analysis with the Dry Lab

15:30 All hands meeting

- Share observations, challenges
- Closing thoughts? Where to next?
- Complete QuarkNET Survey Update or Full Survey

16:00 End of day

Wednesday, July 20th - Morning Session

Objectives for 20 July

Participating teachers will:

- Explain the origin of the Higgs Boson, how it was discovered, and what we have yet to learn.
- Create and use a mass histogram to analyze data from ATLAS or CMS
- Explain different particle decay processes that give rise to a four-lepton signal

09:00 Check-in, re-start

09:15 Data Activity: Shuffling the Particle Deck (online cards)

Alternative: Quark Workbench (full info)

09:45 Tutorial: Where's Higgs (responses)

10:30 Break

10:45 Presentation: What We Have Learned, What We Seek about Higgs

(Prof. Dorival Gonçalves)

11:45 Reflection and discussion

12:00 Break

- Lunch

Wednesday, July 20th - Afternoon Session

13:30 Introduction to CMS (Stupak)

14:00 Search for Higgs in CMS Data

- Take breaks as needed
- Intro slides
- Z-mass activity (calculator) (data) (online protractor for Chrome)
- MassCalc spreadsheet
- iSpy for Higgs@10 (results form) (output)
- Mike Plucinski's Higgs@10 Notebook

16:00 End of day

- Group photo!

Thursday, July 21st - Morning Session

Objectives for 21 July

Participating teachers will:

- Discuss and develop plans for implementing activities into their classrooms
- See some active research labs
- Brainstorming with
- Feedback and brainstorming for future workshops

09:00 Welcome to the last day

09:05 Opportunities for Students from Underrepresented Groups

- Discussion with Dean Freeman, Senior Inclusion Officer

09:30 Share-a-thon, reflection, implementation planning

- Veteran QN teachers share their expertises: activities they already do, what works, what doesn't
- Reflect on the new activities from this workshop
- Discuss how to implement activities in your classroom

10:20 Break

10:30 Rosenberger Photonics Lab Tour

(Physical Sciences 551)

11:00 Meyers Materials Growth and Characterization Lab

11:30 Benton Radiation Physics Lab

(Drive/Carpool to to Venture 1 Building, 1110 South Innovation Way Drive)

12:00 Break

- Lunch

Thursday, July 21st - Afternoon Session

13:30 How can OSU help in your classroom?

(Zoom: https://zoom.us/j/2763137742)

- Brainstorming with the Physics Dept. Outreach and Recruitment Committee
- Set up guest lectures, demo days, other activities
- Notes: Notes from QuarkNet meeting with OaRC

14:30 Break

14:45 Closeout

- Feedback on the 2022 workshop
- Ideas and plans for the future
- Complete QuarkNET Survey Update or Full Survey

15:30 End of Workshop
