

All activities are in Mamiya Science Center, room M104

- 8:30am Arrival/Registration
Welcome students to Masterclass, sign in sheet, nametags
Ask students to sit at tables in groups of 3 or 4
- 8:50am Hands-On Activities (T. Coke, others?)
3 tables will do one activity for 30 minutes while the other 3 do the other activity
- Student Investigations with Rolling with Rutherford Activity
Students will roll balls to an unseen target and consider how Rutherford came to his conclusions about the nucleus. Mentors mingle with groups to listen and answer questions. This will be a time to encourage them to ask questions and think about what particle physics is and what is going on.
- Student Discussions with Quark Puzzle Activity
Students will play with the Quark Puzzle pieces and learn how quarks can combine. Mentors mingle with groups to listen and answer questions.
- 9:10am Switching activities
Students will pack up their activity equipment and swap it with a table that did a different activity.
- 9:30am Introductions
(T.Coke will introduce physicists and show Q&A document)
Introductions of physicist speakers
Very brief overview of particle physics to lead into speaker topics
- 9:45am Dr. Jason Kumar
The Standard Model and Beyond!
- 10:00am Analysis preparation with Guided Practice (T.Coke)
(T.Coke, all physicists, grad students, physics teachers)
[Review](#) of the presentation describing the data they will see. Describe [I-Spy](#) and [CIMA](#).
- 10:20am Short Break
- 10:30am Dr. David Rubin
Using Supernovae to study Dark Energy

- 10:45am Start analysis in pairs
*Lead the students through as they open their laptops and get to the website.
Other teachers, professors will troubleshoot if needed if there are issues getting/reading data
Students bring their computers and get started in pairs after guided practice.*
- 11:15am Dr. Jeremy Sackstein
Supernovae, the CMB and the Hubble Tension
- 11:30am Panel Discussion with J. Kumar, D.Rubin and J.Sackstein
Students have an online document to ask questions if they don't want to speak up, they also will be able to ask in the moment.
- 12pm Lunch with a physicist
Pizza!
*Students will spread out amongst the tables, each with a different physicist. Questions from students are encouraged. Common casual questions include
"What's a day in the life of a physicist like?"
"What's the difference between the work of theoretical and experimental physicists?"
"How did you get into physics?"
"What classes did you take in college that you liked best?"*
- 12:30pm Wrap up Data Analysis (student centered)
*Physicists walk around students in the classroom, listening and answering questions
Mentors will listen to student discussions with each other and ask leading questions if the students seem to be veering off track.*
- 12:45pm Pre-conference Discussion of Results
(T.Coke, J.Kumar with input from others)
Students and mentors discuss meaning of analysis results and questions for other institutes.
I will lead the introduction so the students are aware of what we need to accomplish, Jason and other physicists and grad students and will lead them through an understanding of the physics behind their data results. Did they get the masses they expected, the ratios they expected? Why were those ratios expected? If they did not get the expected results, any ideas as to why not?
- 1:00pm Videoconference with Fermilab + students in Mexico
Students will discuss their results with students from other schools in other locations around the world with guidance from scientists at Fermilab
- 1:45pm Conclusions and Evaluation (T.Coke)
Students fill out evaluation of the workshop.