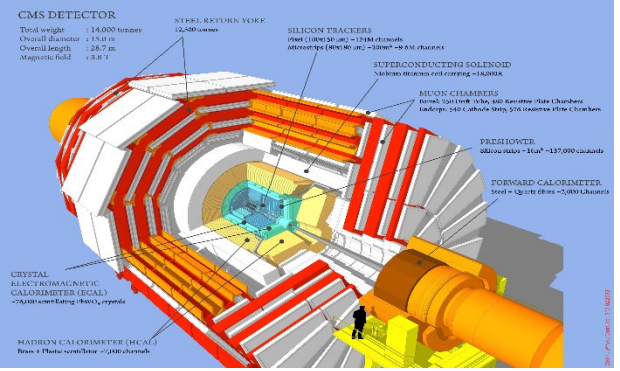
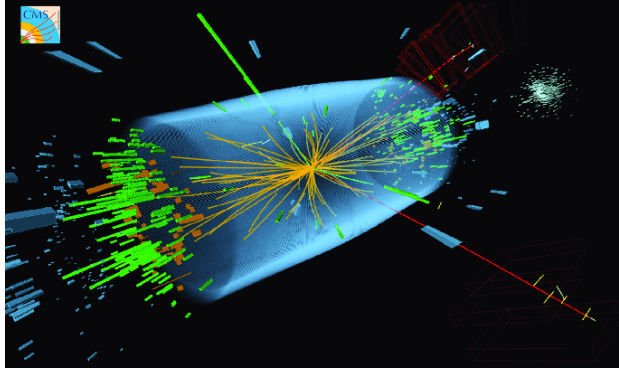


FIRE: THE FIRST-YEAR INNOVATION & RESEARCH EXPERIENCE

SIMULATING PARTICLE DETECTION



Examples of DEI Activities in a Research Course

Müge Karagöz, UMD

CSAAPT Meeting, 4/2/2022

Outline

- Who am I?
- What I teach?
- Diversity & Equity & Inclusion activity examples
- Conclusions

Disclaimers:
I am not a “DEI expert”, but “DEI aware” like we all are.
I am not claiming all material you will see in the next pages are absolutely groundbreaking.
I won’t cover DEI’s importance, or implementations elsewhere. I will cover how I try to address it.
I hope to share and brainstorm through this opportunity.

Who am I?

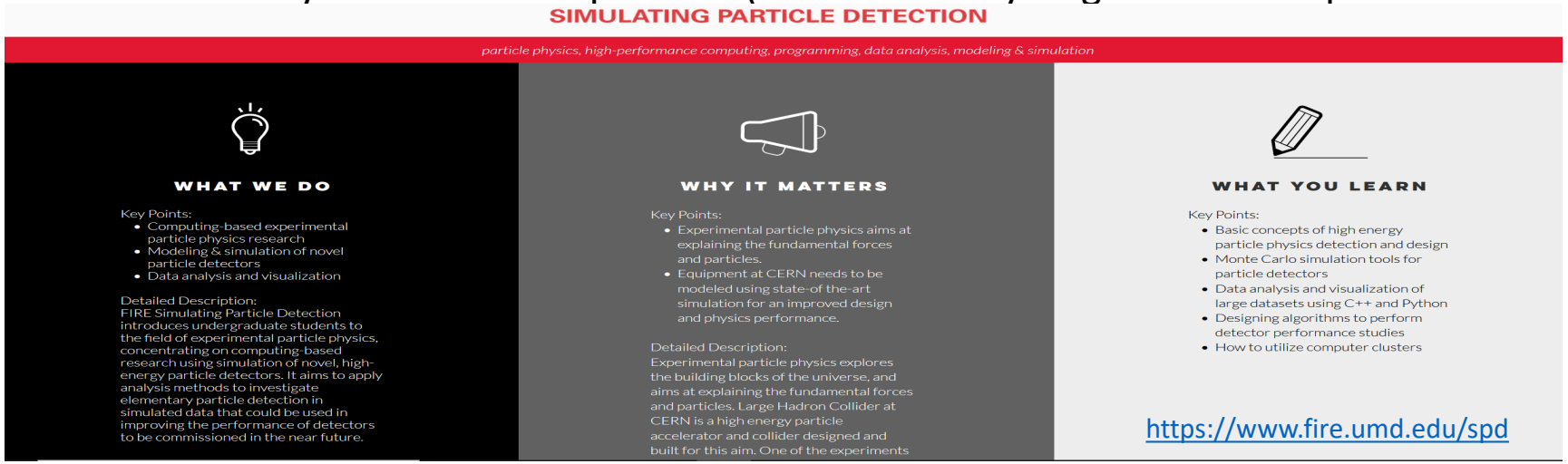
- A British-Turkish particle physicist who lives in the USA
- Mother to an 11-year old
- Ph.D., Physics & Astronomy, Northwestern University
- M.Sc. & B.S., Physics, Bogazici University, Turkey
- Worked at big international and national labs (Fermilab/IL, CERN/Switzerland)
- Taught at universities like Oxford/UK, Chaminade/HI, UMD/MD
- Volunteered and worked at K-12 schools, as well as labs like LIGO/WA
- Why telling you all this? Exposure to diverse, large and international scientific communities adds immensely to one's world-view!


Image courtesy LIGO


http://physics.rockefeller.edu/luc/images/CDF30May2002.jpg

What I teach?

- SPD (“Simulating Particle Detection”): A 2-semester research course as part of the gen-ed UMD First-year Innovation and Research Experience (FIRE) program. Course has 1 hr lecture and ~4 hrs/week lab time in a semester, with a limited enrollment summer research.
- Aim to instill appreciation of curiosity-based basic sciences (gen-ed course).
- Introduce students to experimental high energy particle physics (HEP), concentrating on computing and data analysis, specifically CMS@CERN’s upgrades. Authentic research!
- Reasonably autonomous in research and curriculum.
- Following HEP philosophy: collaboration & community, leadership, peer-reviewing, resource-sharing, mentoring.
- Find it useful to add a variety of in-class components (not necessarily targeted to the specific research questions)



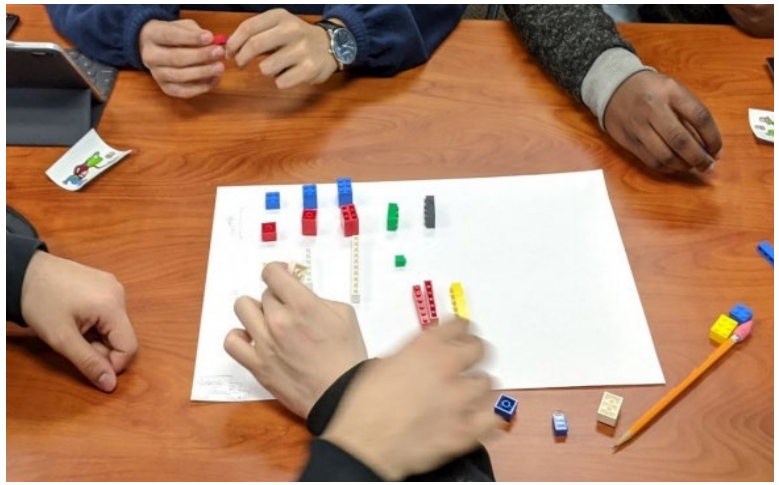
DEI through community & teamwork

by P. Kulkarni

- SPD is a research group of one Faculty Leader, ~ 30 students, ~4 Peer Research Mentors (PRMs) a year.
- Being a gen-ed first-year course, it is a very diverse group of students from different majors which forms a great community at the lab, and not just a class – which I love!
- For teamwork projects, always highlighting “diversity brings strength”
- Guidance for students to be independent researchers but also helpful peers (resource sharing and help-seeking).
- A lab that is open 5 days/week helps for a community
- Digital community (slack) gives students a chance to be included in the community anytime
- Actively including students, especially PRMs, in decision-making, and making sure to cite/thank students if I use their ideas
- Making sure students are able to access material and resources easily (though, in a computational lab where students use their own technologies, this is the trickiest goal to accomplish)

Some activities/topics include

- Ice-breakers and team-building activities in class and at the lab can be fail-safe activities for instilling DEI principles
- “Getting-to-know-you” kind of activities:
  - I ask team members to write an interesting unknown fact about themselves, then give that paper to another team member, to read to the rest of the team. Done this way, we learn and talk about others, but not about ourselves.
  - “Which movie/book do you like?” kind of activities help find common elements within a group – and teaching moments if conversation takes a heated “star wars is better than star trek!” direction!



Team activities and parties/events foster inclusivity in the community

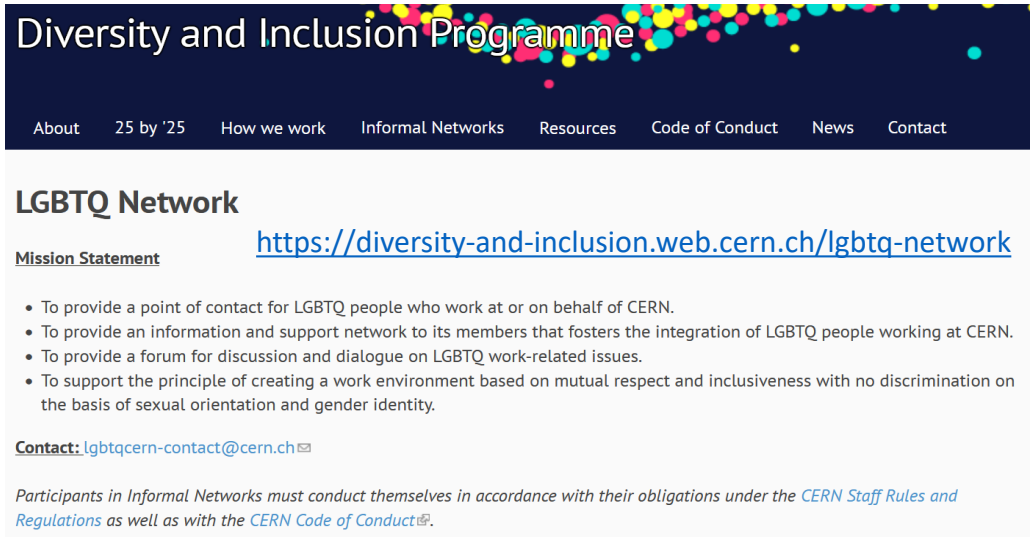
Using highlights from research field

- Science aims to bring us together and acknowledges our diverse backgrounds…

https://home.cern/about/who-we-are/our-history

Science for peace

CERN's convention states: "The Organization shall have no concern with work for military requirements and the results of its experimental and theoretical work shall be published or otherwise made generally available."



https://cds.cern.ch/record/2204857

Inviting guest speakers

- Guest speakers are great ways to introduce students to the diversity of individuals in a field, as well as exposing them to academic and personal experiences of those individuals.
- In the summer and fall 2020, I organized a guest speaker series, called "**FacesOfHEP**"*, which included visitors from highly distinguished experts. One purpose of this series was to expose student to how these distinguished researchers (specifically featuring women and under represented groups) may have overcame any obstacles (if any) to get to their positions (inspired by "Faces of Dune" series, but with added goals in mind).
- In the fall of 2021, another regular guest series, called "**RCR in HEP**" on responsible conduct of research, which included prominent scientists who also do physics outreach. To my mind, performing public outreach is heavily related to careful consideration of DEI.

One of our distinguished guests on zoom.

Book clubs, media resources

- A STEM course/lab can hold book clubs, movie screening hours, create resources lists to discuss DEI issues.
- Especially summer internships are good platforms to extend the technical research to societal aspects in a scholarly fashion.
- In summer 2020, we created a list 2020 resources list with my students for the summer (not required part of the program, but recommendations).
- In spring 2021, we created a HEP book club with my PRMs. The list of options to read included well-known books of societal discussions of HEP research environment.

Social Justice, Anti-racism and Diversity Resources
Please add to this list!

Books

1. *Stamped* by Ibram X. Kendi and Jason Reynolds
2. New books by UMD alumni https://today.umd.edu/articles/happy-ending-3-terp-authors-6d2d839f-ffba-4367-bf75-4e[redacted]4eecc09b0 (one is listed already above)

Movies/ Documentaries

1. *13th* (Netflix)
2. *Just Mercy* (free right now on Amazon Prime)

Other Resources

1. Particles for justice web site has some resources

UMD resources:

1. Office of Diversity and Inclusion has some resources

Name	Author	Topic/Class	No pages	UMD has e-copy?	PRM Votes
The large hadron collider	Don Lincoln	Experiment, history	238	n (IL)	
Understanding The Universe	Don Lincoln	Particle theory	600	y	
In Search of Schrödinger's Cat	John Gribbin	Quantum theory	300	y	[redacted]
The New Cosmic Onion	Frank Close	Particle theory, experiment, history	232	?	[redacted]
A Short History of Nearly Everything	Bill Bryson	Everything, history	544	?	
Nobel Dreams	Gary Taubes	Experiment, history, sociology	261	n	[redacted]
QED: The Strange Theory of Light and Matter	Richard Feynman	Theory, experiment	176	n	
The first three minutes	Steven Weinberg	Particle theory, cosmology	224	?	[redacted]
Mr. Tompkins in Paperback	George Gamow	Quantum theory, relativity	210	y	
Facts and Mysteries in Elementary Particle Physics	Martinus Veltman	Particle theory, experiement, history	350	y	[redacted]
From the Web to the Grid and Beyond	Rene Brun (editor)	Computing, history	380	n (IL)	
[redacted]	Jon Butterworth	Experiment, history	304	y	
Beamtimes and Lifetimes	Sharon Traweek	Experiment, history, sociology	206	y	
The [redacted] ML learning book	Andriy Burkov	computing, intro to ML	136	n	
Physics of the Impossible	Michio Kaku	Theory, futuristic	352	?	[redacted]
We Have No Idea: A Guide to the Unknown Universe	Jorge Cham, Daniel Whiteson	light read, humor, particles, cosmology		y	[redacted]
The Making of Atomic Bomb	Rhodes	history, radioactivity, etc.			

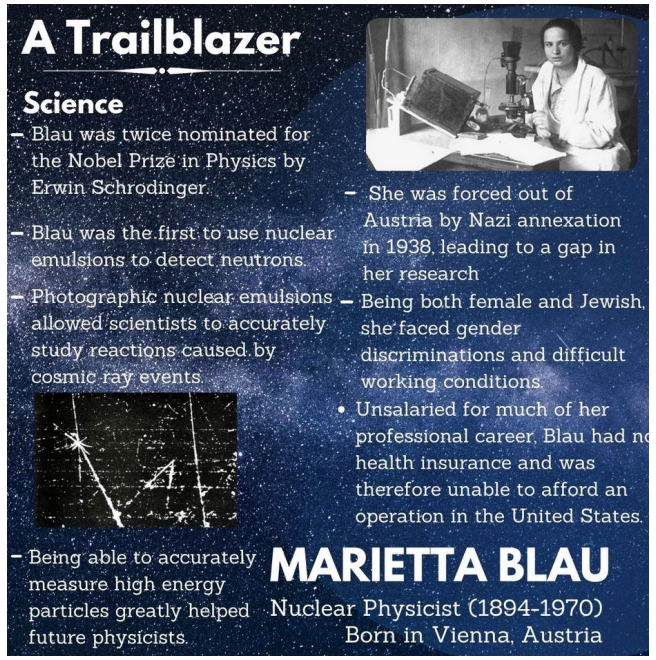
Specific projects/modules:

- DEI assignments/modules can be added to a STEM curriculum as part of additional learning outcomes.
- A group project idea I had for 2022 easily became a part of my 2022 DEI learning outcome in FIRE this semester.
- Students learn about history and current status of science by investigating some important scientists, while aiming to raise awareness in some aspects of DEI issues in science, in particular gender-bias, and in relation to physics.
- The project also serve as an exercise to improve infographics design skills, collaborative work skills as well as RCR in scientific public outreach awareness.
- A web page to hold all the finalized Instagrams and their details is being created by my current Lead PRM.
- This project touches upon where society goes wrong (adverse affects in scientific output), but I also cover in my classes where science can go “wrong”:
  - With biases introduced in (ML) classification algorithms, especially when applied to social sciences, this one is easy to fold in with examples as well.

Women in Physics, Astronomy and Computing

Please find below the suggestion pile for ASN3 Outreach Training assignment.

Scientist	Team (team and member names)
Marie Curie	N/A (please do not pick)
Lise Meitner	Group 9
Maria Goeppert-Mayer	Group 6
Emmy Noether (mathematician, theory)	Group 11
Marietta Blau	Group 2
Rosalind Franklin	Group 5
Helen Edwards (accelerator)	Group 4
Helen Quinn	Group 3
Martha Ayton	



Exemplar ongoing work of my students

Conclusions

- Teaching a research course where I lead and design the curriculum/material, I find it powerful to add active-learning components in my classes.
- For the last four years, I have been lucky to design my course in such a way that I was able covers not only technical research aspects, but also societal aspects, like DEI.
- While I create many of my in-class activities or teaching modules, I am proud to bring in my experience from 20+year of experience in world's leading large collaboration experiments.
- DEI issues have not been today's news, and I am happy to see universities like UMD taking big steps and embarking large campaigns on this.
- With DEI, it is so easy to fall into pitfalls even with the best intentions, so as an educator I am constantly aiming to learn from my own mistakes as well.

Any questions/comments?

- I am happy to brainstorm with especially HS teachers on DEI modules, as well as any information they would like to know on high energy physics research. Please feel free to drop your questions and comments to *mkaragoz@umd.edu*.
- More information on me, my teaching philosophy, and my research group can be found via links here
- Thank you!

Acknowledgements: UMD FIRE, UMD Physics, UMD CMS groups and the whole HEP community. My amazing students!