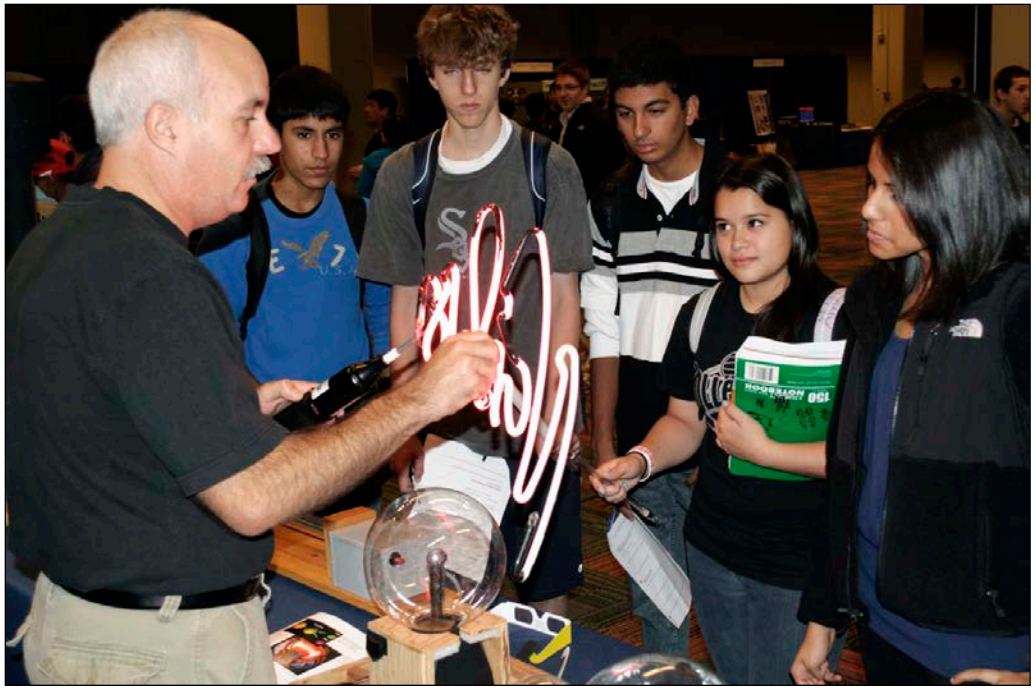
Engaging Cities with APS Science:

How the APS-Division of Plasma Physics plans outreach events for their annual meeting, and what they create.

Paul Rivenberg
MIT Plasma Science & Fusion Center, Education and Outreach Coordinator

Goals

The broad goals of the APS-DPP Fall Meeting Education Activities Committee are to…



- Excite MS and HS teachers and students about physics and physical science
- Provide teachers a chance to talk with physicists in order to provide a better understanding about the life of a research physicist
- Forge a connection between the teaching community and the scientific community

It takes a Team

Largely made up of scientists, education professionals and administrators

Arturo Dominguez, Princeton Plasma Physics Laboratory, **APS-DPP Education Chair**

Deedee Ortiz – PPPL

Shannon Greco – PPPL

Julie Harris – General Atomics

Paul Rivenberg – MIT PSFC

Saralyn Stewart – APS-DPP

Vinaya Sathyasheelappa – APS-DPP

Valerie Censabella – MIT

Ellen Zweibel – **DPP Program Chair 2019**

David Newman – **DPP Chair 2019**

Edward Thomas – **DPP Local Coordinator 2019**

Discover Plasma

Teachers Day

Tuesday

- Registration 8:15-8:30 AM
- Welcome
- Introduction to Plasma
- Workshops
- Lunch with Scientists (provided)
- Workshops
- Conclusion (~3:00 PM)
- Poster Session
- (Badge good for all sessions.)

Plasma Science Expo

For Students:

Thursday 8:30 AM - 2:00 PM
Friday 8:30 AM - 2:00 PM

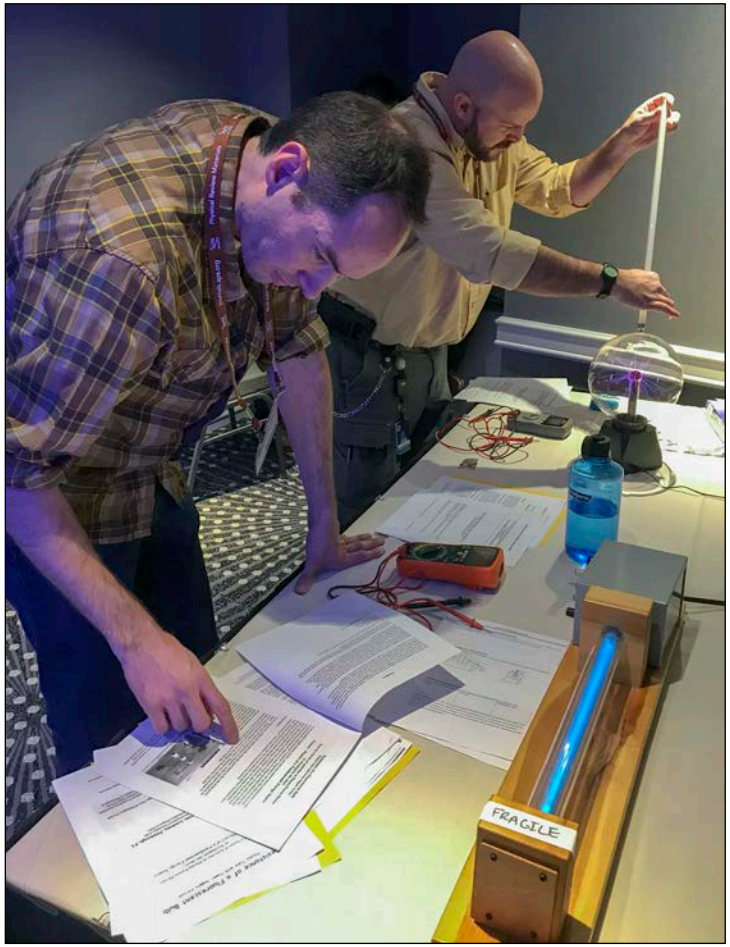
For General Public:

Thursday 6:00 PM – 8:30 PM

Teachers Day Introductory Workshops

PLASMA 101
Intro to Fusion Energy & Plasma Science for 3 audiences

1. Middle School Teachers
2. High School Teachers (general)
3. High School Teachers (AP Physics)



In-depth Workshops (tailored for grades 6-12)

Teaching Plasma Physics Through Classroom Demos

TOPICS include:

- Electromagnetic spectrum
- Light and the Nature of Matter
- Fusion demonstration activities
- Stars

Spectra's Energetic Escape: Physics Through Comics

Lunch with Scientists/ Gifts

- Plasma Ball
- Half-coated plasma tube
- Wall charts
- Curriculum

Teachers Day evaluations

Representative written comments:

- *This is an excellent workshop. I enjoyed all of the lessons. I gained greater knowledge about plasma.*

- *This is something you should continue to offer for teachers. There are few opportunities for science teachers to get together and expand knowledge to get kids more excited about learning. Plus—it's nice to get to be a nerd again*

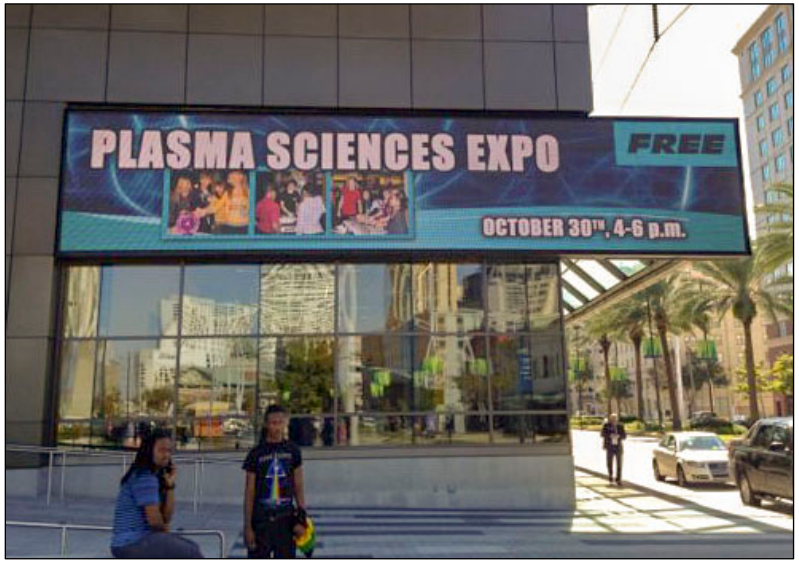
- *Wow it was so nice to get out of the classroom and rub elbows with real scientists!! Thank you!! Thank you!!*

Poster sessions

- Education posters
- Student posters
- Research posters

Interactive Plasma Science Expo

- 20+ exhibitors, two days (Thursday, Friday)
- Exhibitors are laboratory, museum, or university-based; and now even high schools
- School groups visit for 90 minutes to explore the exhibits
- Presenters range from graduate students to senior scientists; even local high school students



More Expo Interactive Activities

Biking for energy.

Creating “fusion reactions” in a shoe box.

Site Visit

Conference Hotel – Teachers Day
Convention Center – Expo

(It's good when they are close together.)

- Which rooms do we use for each workshop?
- Where do we store our supplies?
- Can the room be darkened?
- Where do the teachers park?
- How do the teachers get from parking to the TD meeting place?
- Where do the buses drop off and pick up for the Expo?
- Where do buses park?
- Which route do students take to the Expo that is least disruptive to the meeting?

Meet with local STEM Leaders

How does plasma relate to the curriculum?

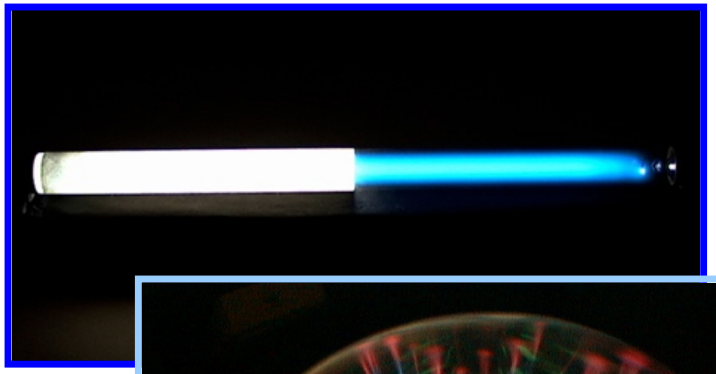
- Plasmas can be used to enhance many topics already in the physical science curriculum.
- Example topics range from the simple (color, light, etc.) to the more complex (electric circuits, atomic physics, conservation of energy, electromagnetism, etc.)
- Plasmas engage student curiosity
- Plasmas generate questions and stimulate inquiry-based learning.
- Their use is consistent with state and national science standards.

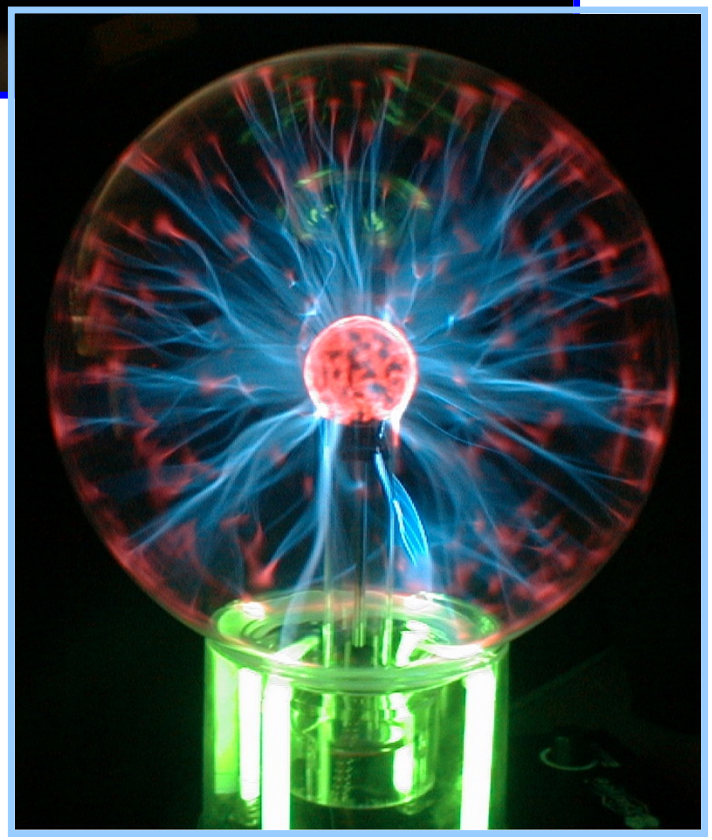
APS/DPP Educational approach:
Plasma Physics need not be taught as a separate unit, rather it can be woven into existing curricula, enhancing the topic.

Plasma science is accessible to classroom instruction

Experiences applicable to your classroom

- Fluorescent lights
- Plasma ball
- Spectrum tube
- Flowing current in a coil to make a magnetic field
- Electromagnetic spectrum
- Modeling fusion reactions





Meeting with local STEM leaders

Questions

- How difficult is it for teachers to get leave for professional development?
- Do they need money for substitute teachers? APS-DPP will foot the bill up to a certain amount.
- How do we get them professional credits for coming to the TD program?
- Do the teachers want certain topics covered?
- Do the schools need money for buses to the Expo?
- Do the buses have to be back at the school by a certain time?

Getting the Word Out

- Communications via local administrators
- Registration Website
- Social media
- Snail mail (postcards)
- Phone

Overview
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What is Plasma Physics?
Informational Flyer
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What is Science Teacher Day?
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Photo Gallery
Maps and Directions
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Contact Us
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Science Teacher Day, October 22, 2019
Student Plasma Science Expo, October 24-25, 2019
General Public Science Expo, October 24, 2019

Register Now!

Join us for a day of engaging workshops that will help you electrify your curriculum, and a Plasma Science Expo where you and your students can explore familiar concepts of light, electricity, and magnetism with an unfamiliar state of matter - Plasma! **ALL FREE!**

Presenters at both the Science Teacher Day and the Plasma Science Expo include members of national and international laboratories, universities and industry who will share their knowledge and enthusiasm for science with teachers and students while making the science accessible and engaging. These two free events provide complimentary resource materials for your school and opportunities to interact with well-known plasma physicists.

The Science Teacher Day connects key concepts from Florida state standards and the Next Generation Science Standards (NGSS) to plasma science and fusion energy, providing a unique way to make the fundamentals new and exciting.

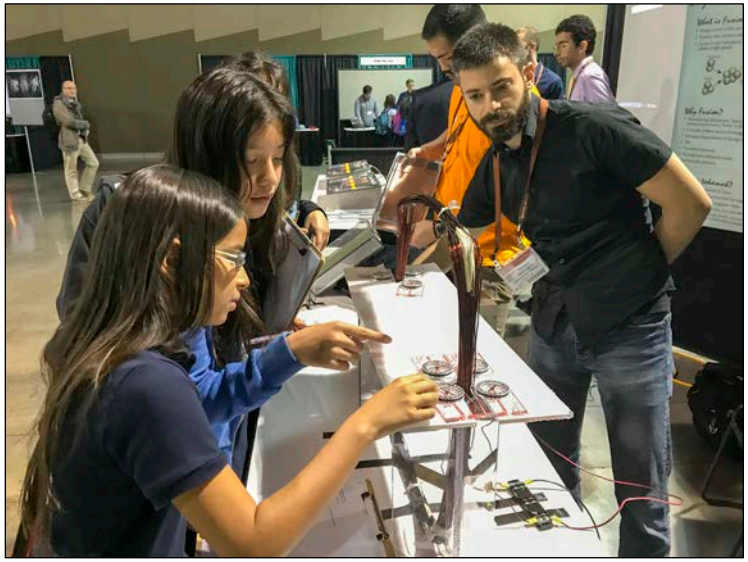
The Plasma Science Expo allows you and your students to engage with scientists on the cutting edge of fusion energy and plasma research, exposing students to new fields and career paths they might otherwise never experience.

Sponsored by the
American Physical Society - Division of Plasma Physics

Where are we are going?
The program is typically held at the Fall meeting of the Division of Plasma Physics of the American Physical Society. The upcoming locations are:

Locations are:
- 2019 Fort Lauderdale, FL October 21-25
- 2020 Memphis, TN November 9-13
- 2021 Pittsburgh, PA November 8-12

Expo Organization



Confirm participation of past participants.

- Coalition for Plasma Science
- Contemporary Physics Education Project
- General Atomics
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- Massachusetts Institute of Technology
- Princeton Plasma Physics Laboratory
- ITER (US Organization)
- Auburn University
- Columbia University
- University of California, San Diego
- University of Rochester, Laboratory for Laser Energetics
- University of Wisconsin

Expo Organization

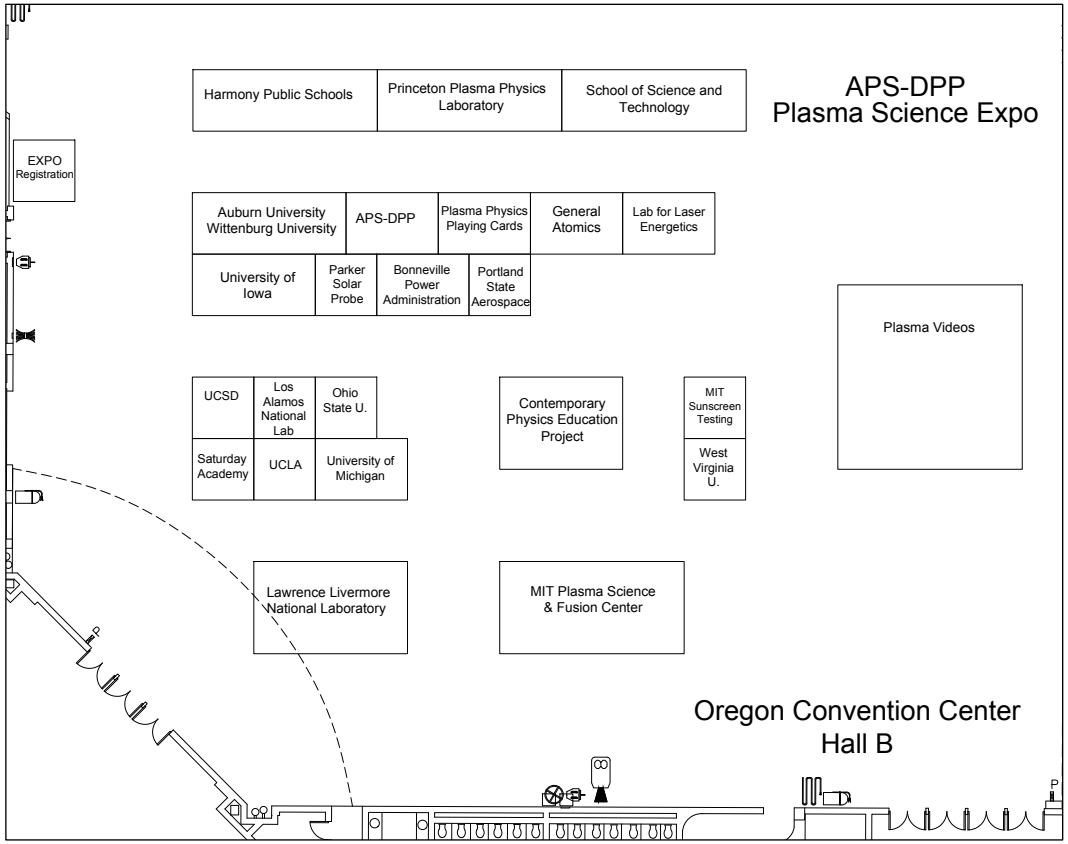
Seek local participation.

The more booths, the more people can come at one time.

- Local SPS and universities
- Local physics/energy-related institutions
- Middle and High schools
  - Harmony Public Schools
  - School of Science and Technology, San Antonio, TX

Expo Organization

- Arrange space and furniture for the booths (floor plan)
- Staff with researchers and students attending the meeting
- Request ”Questions & Answers” from the exhibitors
- Manage requests from local educators
- Monitor maximimum # of attendees per time slot. 350-400



New Avenues

High School Plasma Science Fair
Milwaukee, WI

Science on Tap
Portland, OR

Funding

- Department of Energy
- American Physical Society – DPP
- Individual Participating Institutions
- Contributions from DPP members

Acknowledgements

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- Valerie Censabella – MIT
- Don Correll – retired, Lawrence Livermore National Laboratory
- Carol Danielson – retired, General Atomics

School of Science and Technology, San Antonio