OUTREACH STRATEGIES

for nuclear science and beyond

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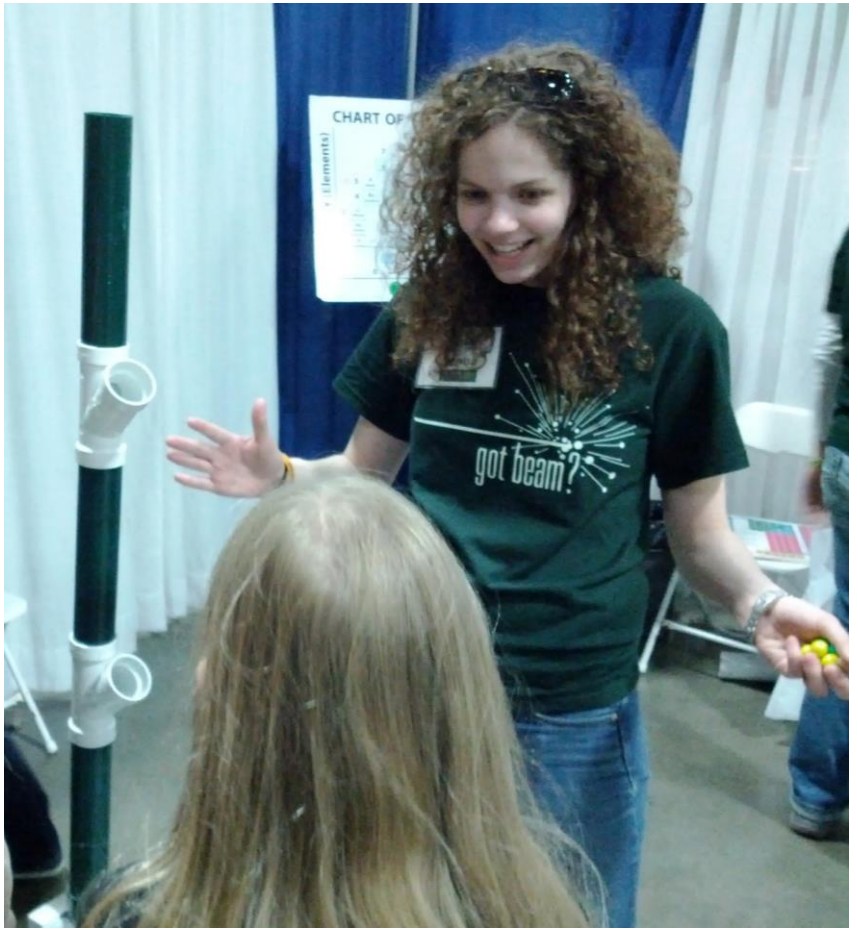
Why do Science Outreach?

What is the *value*?

- An opportunity to share why your work is important
- Create public awareness & appreciation for science
- Spread excitement for science (and maybe rekindle your own)
- Recruit future scientists
- **Change attitudes**



Outreach benefits volunteers as much as the community!

Advantages of Informal Learning

Your audience is:

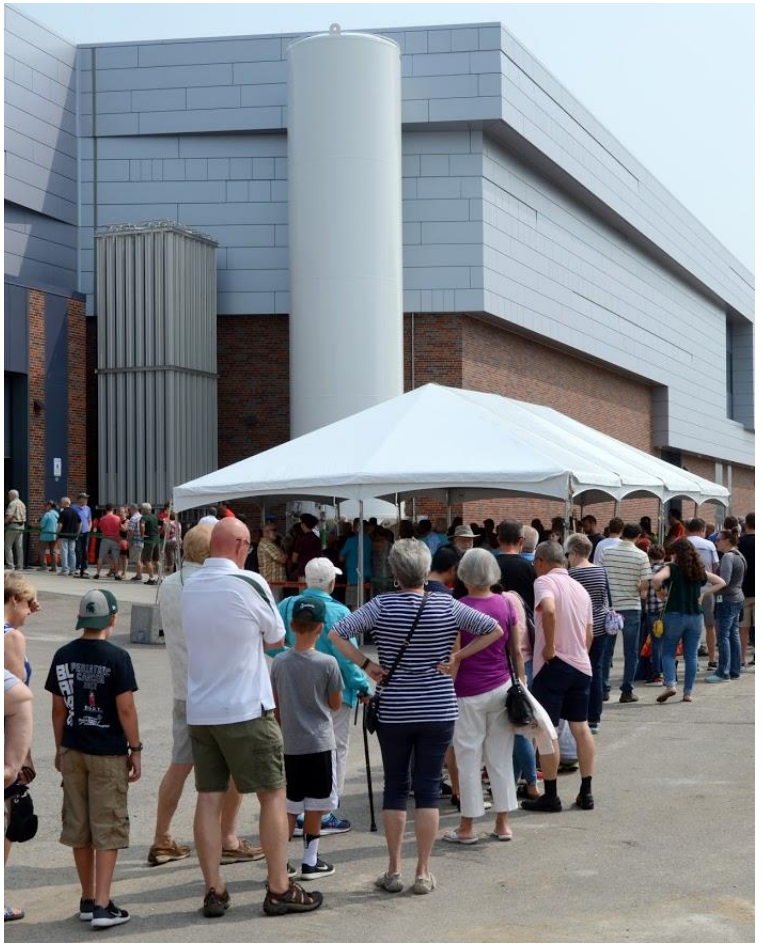
- Seeking information
- Motivated by curiosity
- (most likely) New to the subject
- Likely to be attentive, since they are unsure of what to expect
- **More relaxed** when interacting with science outside of class

Opportunities for Everyone

Larger audience/Less interaction

- Social Media/Website
- Digital Games
- Science Festivals
- Open Houses
- Talks/Webinars
- Tours
- Lessons/Activities
- Camps/Workshops

Smaller audience/More interaction



The Education Pipeline

Pre-High School

- GUPPY (grades 4-6)
- Grandparents' University (grades 3-6)
- MST@MSU (grades 7-10)

High School

- PAN@MSU
- Physicists Inspiring the Next Generation
- High School Honors Science Program (HSHSP)

College

- NS^3
- Research Assistantships
- Summer Research Experiences/REU
- Conference Experiences for Undergrads

Graduate School

- Workshops/Schools
- Conferences
- Connections to open positions

Broad-reaching: promote awareness

- **Festivals and similar public events**
  - Demonstration booths at expo-style venues
  - Hundreds or thousands of visitors in a weekend
  - Short interaction time
  - Focused message tied to hands-on demonstration
- **Open Houses**
  - Recent Open Houses attracted ~4000 visitors, 4x as many as previous events
  - Great opportunity to connect with our community
- **Isotopolis** (APS, JINA and MSU partners)
  - Huge potential audience
  - Low barrier to access
  - Fun, compelling
  - Visual & interactive
  - Depends heavily on advertisement and quality
  - Local teacher commissioned to create lesson plans consistent with NGSS (funded by JINA-CEE)
  - >26,000 unique users

Personal Touch: promote understanding

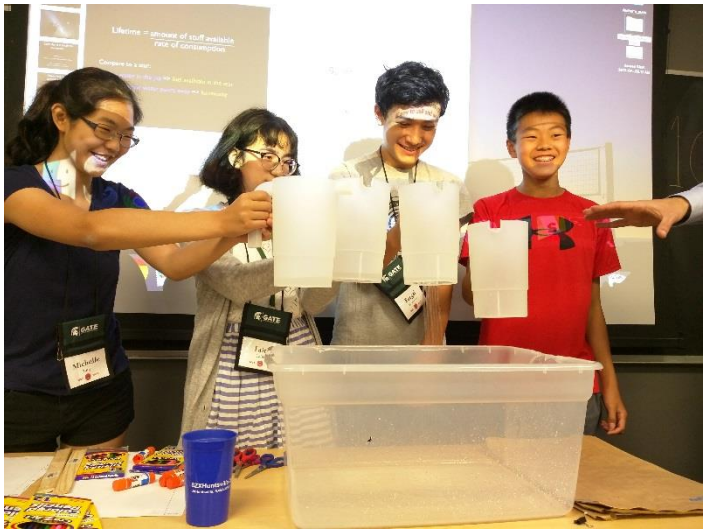
- **Laboratory Tours**
  - Customized to audience level and interest: schools, MSU visitors, community groups, families, on-campus programs
  - Up to 4000 visitors/year
  - Trained grad students guiding
  - Appreciation of scope, purpose and methods
- **Invited Talks about NSCL**
  - Customized to audience level and interest: schools, alumni clubs, conferences, science cafes, MSU visitors
  - For the general public: overview of nuclear science at MSU
  - For pre-college students: outline of our research with focus on research careers
  - Flexible in location, reaching ~3000 people/year
  - Impart understanding of research value and opportunities
- **Lessons**
  - A series of activities that introduce nuclear concepts using hands-on model
  - Over 300 students/year
  - >400 teachers trained to use in their own classrooms

Focused impact: creating scientists

- Intensive programs in partnership with JINA-CEE

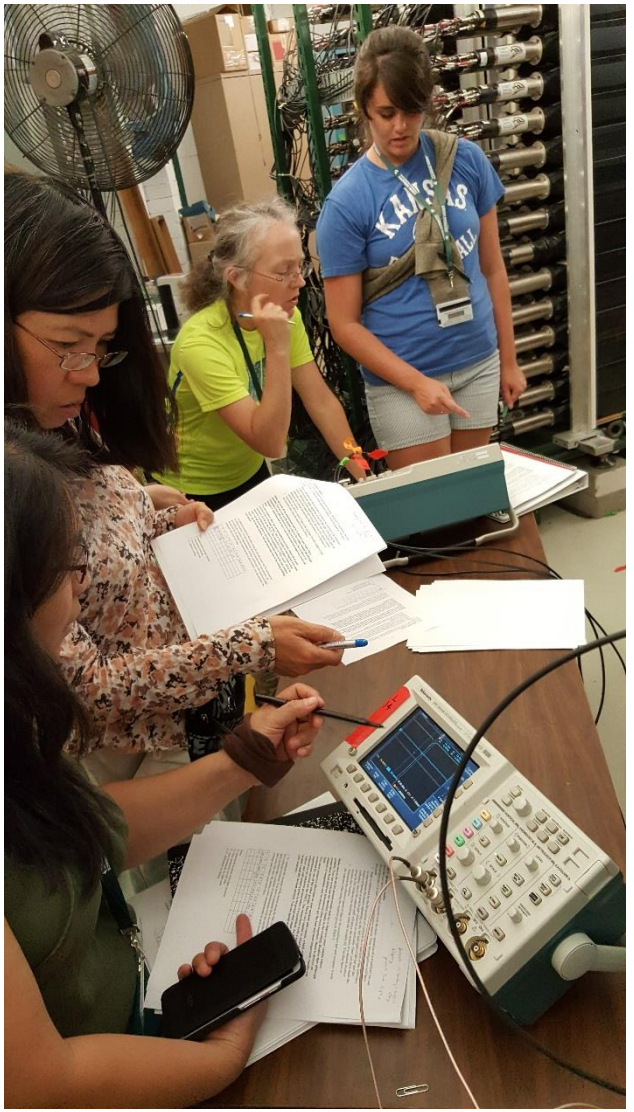
- **Physics of Atomic Nuclei (PAN@MSU)**
  - Free week-long residential summer program for 24 HS students (2022 is our 29th year)
  - Incorporates exposure to current research, training, and hands-on experiments
  - Many PAN alumni go on to attend MSU (17+ currently)
  - Compared with similar peers, PAN alumni are 9x more likely to pursue a STEM major and 8x more likely to pursue a STEM career[1]

- **Math, Science and Technology (MST@MSU)**
  - Week-long summer program managed by MSU GATE
  - Lab provides Nuclear Astrophysics course for 24 middle-school students/year
  - Students exposed to topics beyond their school curriculum and find new interests
  - Many MST@MSU students choose to apply to PAN, citing their prior experience as the reason they are aware of and interested in the nuclear subfield



[1] Constan & Judy, Journal of Higher Education Outreach and Engagement **19**, p117 (2015)

Teacher training (with JINA-CEE)



- **Provide tools, experience, and confidence to incorporate nuclear astrophysics curriculum**
  - Emphasizing the free resources available through FRIB & JINA-CEE
  - Offer nuclear astrophysics demonstrations and instructional tools (e.g. marble nuclei lessons and activities)[2] and how they could fit in the classroom
  - Raise awareness of Isotopolis and coming lesson plans
  - Encourage their interested students to apply to MST@MSU and PAN
- **Connecting with teachers**
  - One-week summer PAN program
  - One-day on-campus seminars
  - **New initiative: science teacher conference workshops ("PAN-CAKE")** for teachers in other states and online
  - Teachers have shared with peers in NJ, NC, MO, TX
  - >400 teachers have been trained to use the "marble nuclei" model, >300 additional teachers have downloaded model and lesson instructions

[2] Constan, The Physics Teacher **48**, p114 (2010)

Partnerships: find the expert

Collaborations allow for multiplication of effort (i.e. 1+1>2)

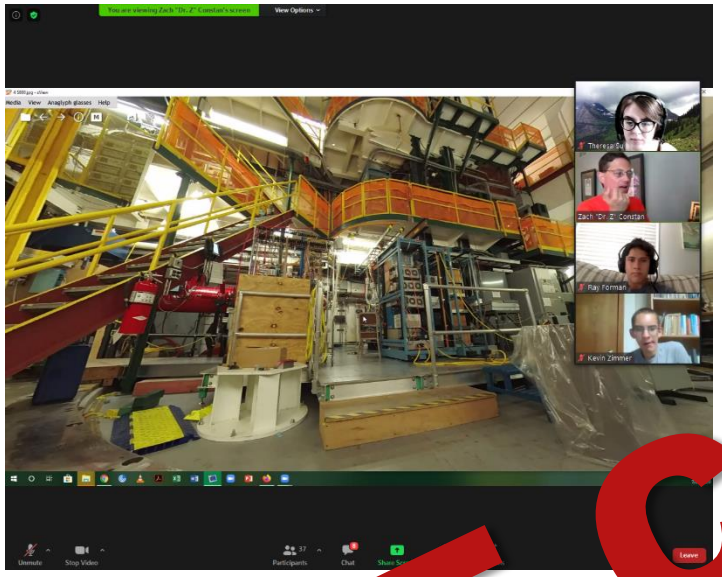
- **Summer programs for various ages** with other offices on campus
- **PAN summer program** assessment with College of Education researchers
- **Isotopolis game** with GEL Lab programmers
- **Presentations/demos** for MSU Science Festival
- **Dance** with Wharton Center and Dance Exchange
- **Virtual tour** with Abrams Planetarium
- **FRIB Exhibit** with Impression 5 Science Center
- **Documentary about FRIB** with filmmaker
- **Road shows** with Detroit schools
- **Common survey & reporting** with Pre-College Committee

How to Improve

- No plan survives first contact with your audience
- **You won’t get it right the first time**
- It’s never really “done”

- Watch audience reactions
- Look for patterns in their questions to find misconceptions
- Get feedback
- Think about your message!
- **Practice makes progress**

The great online migration of 2020



GET CREATIVE

The ability to adapt is critical in outreach!

How will you serve your audience regardless of age, education, interest, or ***relative location***?

- What digital resources do you already have?
- What outreach activities can translate to virtual space?
- What could your audience do with household items?

Assessment of public attitiudes

Attitudes taken from contact with groups before outreach experience:

- Curiosity
- Anticipation
- Concern
- Intimidation
- Confusion
- Bewilderment
- Disinterest

FRIB and JINA have collaborated with MSU College of Education to perform assessments.

Attitudes taken from surveys:

- Amazement
- Interest
- Excitement
- Inspiration
- Enthusiasm
- Gratitude

Benefits of changed attitudes

- **Informed voters and taxpayers**
- **Positive word-of-mouth**
- **Lessened fear of unknown**
- **Anticipation for future discoveries**
- **Greater pool of potential scientists**
  - Quantitative and qualitative evidence that pre-college engagement creates future scientists
  - “My mom has been saying how much she doesn't want me to do [physics or astrophysics] … she's saying there are no job prospects”

Feedback from tour groups

Lessons of effective Outreach

- **Connect** scientists with the public
- **Maximize and support** our volunteers
- **Adapt** our message to many audiences
- **Partner** with experts for content, pedagogy and assessment
- **Leverage** our unique assets
- **Exceed** expectations
- When requested, (almost) always **say yes**
  - *Or offer something else!*
- **Close the gap** with new audiences
- The big one: **constant improvement**