
NUCLEAR SCIENCE OUTREACH ACTIVITIES:

Examples from the Report
on Education and Innovation
for the 2015 NSAC
Long Range Plan

The examples of outreach activities from the U.S. nuclear science community presented in this compilation were solicited for the report from the DNP Town Meeting on Education and Innovation, held August 6-8, 2014 in East Lansing, MI, in preparation for the 2015 NSAC Long Range Plan. These examples are also included in the town meeting report as Appendix D.

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January 2015

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PubSci: Big Bang Physics



Organization: Brookhaven National Laboratory, Stakeholder Relations
Contact: Tara Shiels, tshiels@bnl.gov,
Chelsea Whyte, cwhyte@bnl.gov
Audience: General Public
Funding source: DOE Office of Science, Brookhaven Science Associates

A trio of physicists affiliated with the Relativistic Heavy Ion Collider (RHIC) and two Brookhaven Lab science writers kicked off a new science café series on March 11, 2014. The event, dubbed "PubSci" for its location in a local pub, drew more than 70 community members who were eager to ask questions and engage in conversation about "Big Bang Physics and the Building Blocks of Matter." With the science writers serving as talk show style hosts, panelists Berndt Mueller, Brookhaven's associate laboratory director for Nuclear & Particle Physics, Paul Sorensen of RHIC's STAR collaboration, and Ágnes Mócsy, a theoretical physicist at RHIC and an associate professor at Pratt Institute, presented brief overviews, humorous anecdotes, and a spirit that invited audience participation.

"It's a cool thing that you brought this amazing science out of the borders of the Lab to us," said one attendee. "It was great to hear the scientists talk about themselves and joke around and just be casual. I also really liked hearing about the future of the research at RHIC."

The scientists were equally enthusiastic. "It was an awesome experience to engage with so many interested people in such a public, yet intimate setting," Mueller said. "The many questions we received really helped us convey the excitement of the science."



website: <http://www.bnl.gov/newsroom/news.php?a=24704>

RHIC Features and Press Outreach


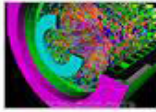




Organization: Brookhaven National Laboratory,
Media & Communications Office
Contact: Karen McNulty Walsh, kmcnulty@bnl.gov
Audience: General Public
Funding source: DOE Office of Science

Brookhaven Lab regularly features engaging stories about the research at the Relativistic Heavy Ion Collider (RHIC) on its public-facing web pages, distributes these stories to the mainstream media, and points to them via social media (Twitter, Facebook, and Tumblr) to encourage wider distribution and independent coverage of our nuclear physics research. Examples include stories at the start and end of the most recent experimental run, features on the careers of physicists trained at RHIC, and updates on scientific findings such as the search for strange baryons and the source of gluon spin. We also routinely attend scientific meetings and science communication events where we pitch coverage of RHIC physics to reporters.

Examples of the payoff from these efforts include: a “How to Make Quark Soup” video featured on NPR’s *Science Friday* broadcast and website, a segment in the *Discovery Science* series “How the Universe Works,” a column on the “awe-inspiring” research at RHIC in *The Wall Street Journal*, prominent coverage in a popular book, *Heat: Adventures in the World’s Fiery Places*, stories appearing on a variety of news sites and blogs, and high-tech elements of RHIC experiments featured in ads for the New York State Empire Development Corporation and Apple Computers.

A graphic titled "News from RHIC" with a green header. It contains four items, each with a small image and a text description:

-  Cooking Up Quark-Gluon Plasma with 'Science Friday'
-  A Closer Look at the Perfect Fluid
-  First Indirect Evidence of So-Far Undetected Strange Baryons
-  RHIC Featured in 'How The Universe Works' on the Science Channel

website: www.bnl.gov/rhic/news2/

RHIC Summer Sunday/Tours



Organization: Brookhaven National Laboratory, Stakeholder Relations
Contact: Tara Shiels, tshiels@bnl.gov
Audience: General Public
Funding source: DOE Office of Science, Brookhaven Science Associates

This year, nearly 100 scientists and engineers working on research at the Relativistic Heavy Ion Collider (RHIC) volunteered their time to explain nuclear physics research and give tours to visitors. Highlights include:

RHIC Summer Sunday: Atom-Smashing Fun

Held one Sunday every summer as part of Brookhaven's series of open-house events, and advertised via local print and radio media, this year's RHIC Summer Sunday on August 3 attracted approximately 1,300 guests of all ages. Visitors took part in interactive demonstrations and toured the RHIC accelerator tunnel and the STAR and PHENIX detectors to learn about the exploration of nuclear matter from the scientists conducting the research. Other attractions included hands-on activities and a "Phenomenal Physics" show in Berkner Hall.



Other FY14 RHIC Tours

This year, an estimated 1,550 guests visited one or more RHIC facilities—including the Main Control Room, RHIC accelerator tunnel, STAR, and PHENIX—as part of tours arranged by the Lab's Stakeholder Relations office. Visitors included local and international high school, college, and university students (e.g., Fujishima High School, Charterhouse School UK, Suffolk Community College, NYIT, Ohio State University, U.S. Merchant Marine Academy), elected officials, community and business organizations (e.g., Women's Club of Riverhead), and conference participants (e.g., Undergraduate Women in Physics). As one attendee said, "It was inspiring to see such advanced technology. I am now interested in applying to an internship or research project at BNL."

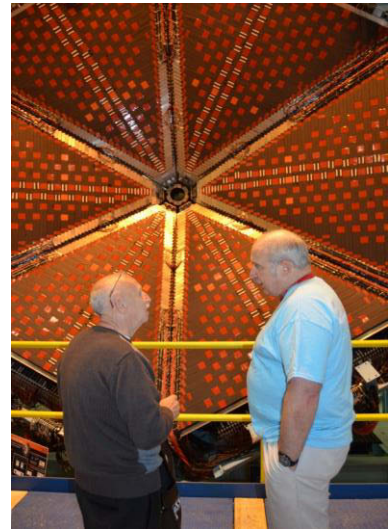
websites: <http://www.bnl.gov/stakeholder/summersundays.php>
<http://www.bnl.gov/stakeholder/tours.php>

Jefferson Lab Open House



Organization: Jefferson Lab
Contact: Kandice Carter
Audience: General Public
Funding source: Jefferson Lab, DOE

Jefferson Lab holds a biennial open house, allowing the public to tour many of its facilities and interact with scientists. During the 2014 Open House: Accelerating Discovery, more than 5,500 visitors toured the ~200 acre site. All four of the lab's experimental halls were open for the first time, and more than 2,200 visitors toured the lab's accelerator. The event also featured R&D centers, local university physics departments, booths from local science centers, cryogenics shows and science lectures.



website: <https://www.jlab.org/openhouse>

NSCL Exhibits at Science Festivals

MICHIGAN STATE
UNIVERSITY

Organization: Michigan State University
Contact: NSCL Outreach, visits@nscl.msu.edu, 517-908-7363
Audience: General public
Funding source: MSU/NSF

Teams of volunteers from NSCL have hosted booths at numerous Science Festivals. Through hands-on demonstrations and one-on-one time with visitors, NSCL faculty/students/staff communicate their passion for research to a large audience in a short time.

Recent events include large venues such as the MSU Science Festival and MidWest Space Fest as well as smaller audiences at the local elementary school's "Science Night." At the USA Science and Engineering Festival in Washington, D.C., over 5000 people visited our booth in three days.



website: <http://sciencefestival.msu.edu/>

NSCL Open House

Organization: Michigan State University
Contact: NSCL Outreach, visits@nscl.msu.edu, 517-908-7363
Audience: General public
Funding source: MSU/NSF

NSCL open houses offer the community a chance to see what nuclear science is and how our work helps solve some of the greatest mysteries in the universe.

Example activities:

- Tour the lab to see superconducting cyclotrons, experimental detectors, and plans for the next-generation heavy ion accelerator.
- Educational movies and science rap videos in "NSCL Theatre".
- Talk with nuclear scientists and graduate students about their work on the frontiers of rare-isotope research.
- Get a personal demonstration of superconductivity, radioactivity, cosmic rays and more in the Expo Area.



website: <http://www.nscl.msu.edu>

NSCL Public Talks

Organization: Michigan State University
Contact: NSCL Outreach, visits@nscl.msu.edu, 517-908-7363
Audience: General public
Funding source: MSU/NSF

Groups that are too large for NSCL tours or can't travel to the lab are offered talks about nuclear science or, for school groups that request it, careers in research (and STEM) fields. NSCL faculty, staff and students often travel around Michigan to tell their story to these audiences. Such talks have been attended by over 2400 guests in 2014.

One talk organizer said: "Your presentation was outstanding and the highlight of the day. Literally every conversation I had the rest of the day included very positive comments about your presentation!"



website: <http://www.nscl.msu.edu>

NSCL Laboratory Tours

Organization: Michigan State University
Contact: NSCL Outreach, visits@nscl.msu.edu, 517-908-7363
Audience: General public
Funding source: MSU/NSF

NSCL offers 90-minute tours “behind the scenes” to groups of 10-50 visitors. Guests include school classes, community organizations, MSU students and alumni, etc. Over 3500 people tour the lab every year. The average tour includes a demonstration-heavy 40-minute introduction to the lab before splitting into small groups for a walk through the experimental areas.

Visitors express great satisfaction with their tour experience, rating it an average a 4.87 out of 5. A sample reaction: “The entire program is a credit to Michigan State University.”



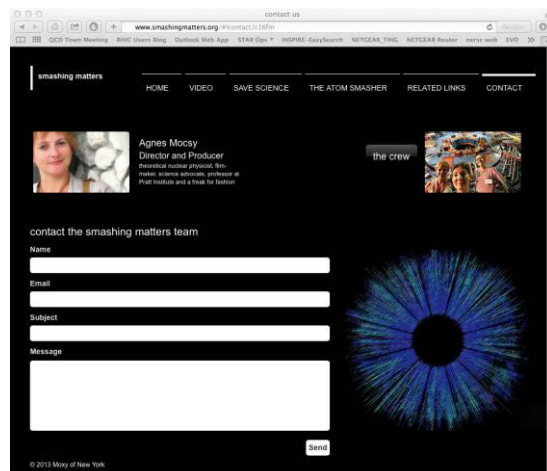
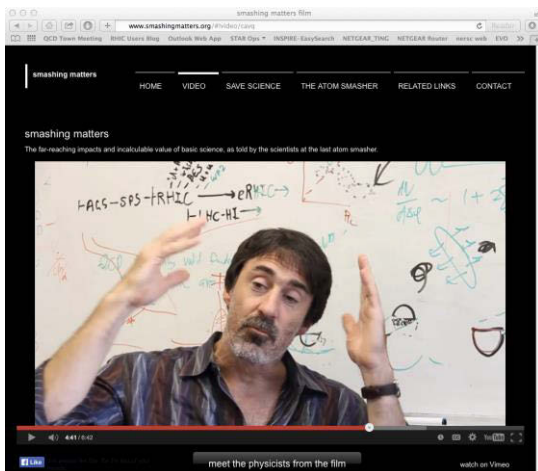
website: <http://www.nscl.msu.edu/public/tour>

“Smashing Matters” Op-Doc and Webpage

Pratt

Organization: Pratt Institute
Contact: Ágnes Mócsy, (917) 209-1516, amocsy@pratt.edu
Audience: General Public
Funding source: Pratt Institute, Brookhaven Science Associates,
Duke University

“Smashing Matters” is an inspirational and informative Op-Doc released in 2013 explaining the importance of fundamental research through interviews and illustrations. The highly polished film was produced in collaboration with film and writing students from Pratt Institute. An accompanying web-page offers more detail on how to support basic research. After viewing this video, representatives from Discovery contacted Prof. Mike Lisa (one of 10 scientists featured in the film) to appear in the show “How the Universe Works” on the Science Channel.

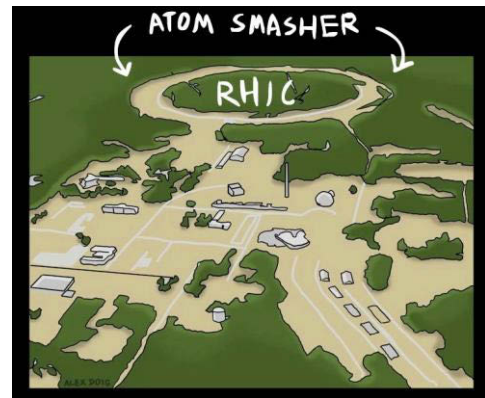


website: <http://www.smashingmatters.org>

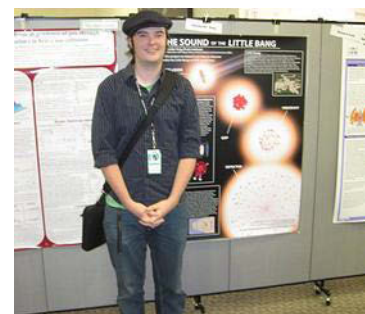
“The Sound of the Little Bangs” Animated Video



Organization: Pratt Institute
Contact: Ágnes Mócsy, (917) 209-1516, amocsy@pratt.edu
Audience: General Public
Funding source: Unfunded



“The Sound of the Little Bang” is a groundbreaking animated video produced in a collaboration between BNL and Pratt Institute. The video provides an accessible explanation of a research breakthrough. The illustrations and animations were created by Alexander Doig, an undergraduate illustration major at Pratt. Alex presented his work at a RHIC/AGS Users Meeting. It was also presented in a talk at an APS meeting where it was selected as one of the highlights of the meeting. The project was written about by dozens of international news organizations and the videos have been viewed by approximately 40 thousand viewers from around the world. The impact of the video has been profound within the nuclear science community as well with verbiage from the narration now regularly echoed in scientific talks. This illustrates how collaborations between diverse fields can be mutually beneficial.



website: <http://soundofthelittlebang.com/media.html>

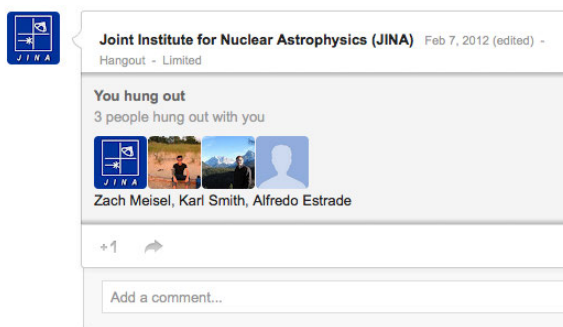
Web Activities

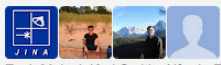
Organization: University of Notre Dame / Michigan State University
 Contact: JINA Outreach, (574) 631-5326, jinaout@nd.edu
 Audience: General Public
 Funding source: NSF

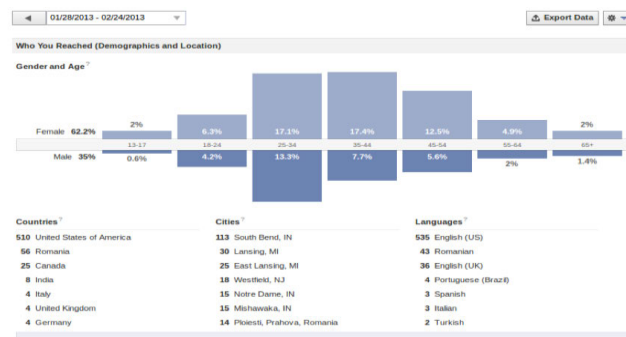
The JINA Educational Gallery offers something for everyone, from movies, coloring sheets, and a slide show based on Harry Potter character names, to teaching materials and advanced course-based lectures. The gallery pages continue to receive 1000+ unique visits each year.

JINA is active in social media on its Facebook, Twitter, Google+, and YouTube pages. The most popular Facebook post to date, about International Women's Day, was seen by over 900 people. Most of the FB fans are women, ages 35-44 who live in or near South Bend. These are most likely mothers of students who have attended a JINA outreach program. We use FB to notify them of other local outreach events throughout the year. Almost 20% of the fans live outside of the United States.

JINA has posted 13 videos on YouTube, which have been viewed 1000+ times. These videos are a combination of educational content and videos about outreach events. The most popular video was a 'fun' experimental parody of the 12 days of Christmas, which was a joint project between scientists at MSU and ND. While growth on Twitter and Google+ have been slower than FB and YouTube, scientists and committees often use Google+ hangouts as a new way to video conference.



Joint Institute for Nuclear Astrophysics (JINA) Feb 7, 2012 (edited) - Hangout - Limited
You hung out
 3 people hung out with you

 Zach Meisel, Karl Smith, Alfredo Estrade



website: <http://www.jinaweb.org/html/jinaprograms.html>

Science Festivals

Organization: University of Notre Dame / Michigan State University
Contact: JINA Outreach, (574) 631-5326, jinaout@nd.edu
Audience: General Public
Funding source: NSF

Celebrate Science Indiana – Indianapolis, IN

JINA scientist participate in the annual statewide science expo in Indiana. JINA partners with a variety of Notre Dame departments and organizations each year. Over 5000 visit the festival and the Notre Dame booths regularly have 600+ visitors.

Science Alive – South Bend, IN

JINA staff and students participate in the annual St. Joseph County Public Library's Science Alive. 3,000 people regularly attended the expo, which features over 40 exhibits. Prior to the expo, JINA, ND Department of Physics and ND College of Science sponsor an exhibitor reception to provide an opportunity for exhibitors to network for new collaborations. The JINA room includes marshmallows in vacuum, LN2 demonstrations, radiation detectors, and a light absorption activity with gummy bears. It is often the most attended room by the public (700+) and press, earning JINA a front-page picture in the printed Sunday paper .

MSU Sci-Fest

MSU held their 2nd Science festival over the course of 9 days. One day was reserved for school groups to attend an expo of activities. Scientists from NSCL and JINA partnered for an extended exhibit which takes participants through the entire nuclear experimentation process from fragmentation and separation to detection. It also served as a test run for the USA festival below.

USA Science and Engineering Festival

JINA joined NSCL for the 3rd USA Festival this year. Scientists from NSCL and JINA partnered for an extended exhibit which takes participants through the entire nuclear experimentation process from fragmentation and separation to detection. We estimate 5000 participants took part in our activities.

Website: http://www.jinaweb.org/outreach/outreach_calendar.html



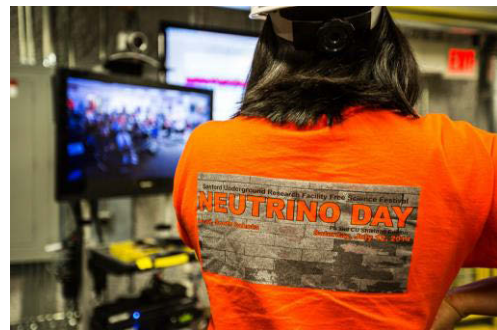
**Sanford Underground
Research Facility**

Neutrino Day

Organization: Sanford Underground Research Facility
Contact: Peggy Norris, pnorris@sanfordlab.org, (605)-722-5049
Audience: General Public
Funding source: Sanford Lab and local businesses and foundations

Neutrino Day is an annual science festival held in the Lead, SD community the second Saturday of July that has grown to attract more than 1000 participants. In 2013, the festival outgrew the surface facility at the Sanford Underground Research Facility and expanded downtown.

The whole community is now involved. At the Sanford Lab site, visitors can tour the Hoist Room, visit displays or ask questions of scientists working at the 4850L of the underground lab via high-definition videoconference. Down the hill in town, science lectures and hands-on activities for kids of all ages take place at the Historic Homestake Opera House, the Library, the Lead-Deadwood Middle School, the Homestake Open Cut and the Black Hills Mining Museum. Buses take participants between locations. Partners include the Lead Chamber of Commerce, the Lead-Deadwood Arts Council, South Dakota Public Broadcasting, Black Hills Power and many community volunteers.



website: www.sanfordlab.org

Street Physics at Texas A&M



Organization: Texas A&M University
Contact: S. Yennello
Audience: General Public
Funding source: NSF & TAMU

The TAMU Cyclotron Institute REU students put together a set of hands on activities and take them to the street – literally - each summer. Our local community hosts a First Friday event once a month where many members of the community fill the streets of downtown to enjoy art, music, and in July - science. It is always incredibly well received by all. The REU students enjoy engaging people of all ages in the fun and often once discussions started they end up explaining their research projects to the public. Numerous people have asked if we would be back other months. The event has been reported in the local paper. One professor in Engineering so liked the idea she approached me about “institutionalizing” it so we would have different groups of science and engineering students bring science to the streets throughout the year.

July is the perfect month for the NSF REU students as they will have gotten comfortable with being at TAMU and with each other and yet it is not so late in the summer that the students feel the tension of too many competing time commitments. Overall, this has been a very successful REU outreach event and we anticipate a similar outreach event will take place each year.



website: <http://cyclotron.tamu.edu/smp>

Science Happy Hour



Organization: Yale University
Contact: John Harris, john.harris@yale.edu
Audience: General Public
Funding source: Yale Physics Department

To quote the news article about the event – “What happens when four physicists walk into a bar?” There are “an infinity” of possible answers to this question. One of them took place in New Haven just off the Yale campus – a “Science Happy Hour” where after a few introductions many questions about science were asked and answered, breeding discussions for the rest of the evening. Before the start of the event, slides were projected on a large screen depicting a Hubble Deep Field Telescope view of space, an artist depiction of the first instants of the Big Bang, an infamous strikingly-visual heavy-ion event, an awe-inspiring view of a behemoth LHC detector, and famous art depicting extra dimensions and distortions of space-time.

In the course of an hour and a half with a public moderator, the four physicists representing ALICE-USA, STAR, US-ATLAS and Nuclear Theory engaged the audience in a vivid discussion of physics topics ranging from the Big Bang to a Quark Gluon Plasma to the Higgs particle. Both the relevance of these in our understanding of nature and how people actually carry out this research were of interest to the crowd. Below are photos of the panel and half the room-full of the inquisitive audience that numbered around 70 at any one time. See the website below for more details about the event and panelists.



website: <http://star.physics.yale.edu/BAREVENT/>

Science outreach at BNL & RHIC



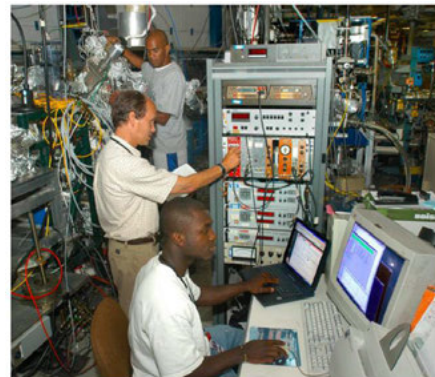
Organization: Brookhaven National Laboratory
Contact: Ken White
Grade Level: 1-12
Funding source: various

A key part of the mission of BNL's Office of Educational Program's mission is to encourage and promote science literacy. This includes participation in a number of DOE funded programs, such as SULI, FaST, CCI, ACTS and PST.

BNL also hosts the BSA funded Science Learning Center, serving 40000 students a year with information on RHIC, NSLS and NSRL.

In a partnership with the NYS Boards of Cooperative Education Services, Exploration Laboratories organize field trips to BNL, with lab activities developed in cooperation with BNL scientists, post-docs and grad students.

In depth high school student experiences are offered by the Minority High School Science Apprenticeship, Community Summer Science and High School Research Program programs



website: <http://www.bnl.gov/education/>

Jefferson Lab Physics Fest



Organization: Jefferson Lab
Contact: Jan Tyler
Grade Level: K-12
Funding source: Jefferson Lab

Jefferson Lab's Physics Fest is a two-hour field trip highlighting nuclear physics, demonstrations with cryogenics and plasmas, and career opportunities in the STEM fields. Nearly 6,000 students attended the events at Jefferson Lab in FY2014.



website: <http://education.jlab.org/physicsfest/index.html>



Saturday Morning Physics at Texas A&M



Organization: Texas A&M University
Contact: R. Rapp
Grade Level: K-12
Funding source: NSF & TAMU

- Introduced + directed at TAMU in 2006 by R. Rapp [part of NSF Career Award], joined by R.J. Fries in 2010 [NSF Career] (adopted from Fermilab version)
- **Entice high-school students about forefront physics research**
- 7 events each spring since '06
- Faculty lecture + discussion - break - quiz/demos/specials
- Well connected: Cyclotron / Physics&Astronomy / College of Science, high-school teachers (give students credit for attendance certificates)
- Involves grad students + postdocs, facebook
- Steady attendance growth, throughout Southeast TX (up to Dallas, Houston, San Antonio)

Year	2006	2009	2013
Average	16	100	145
Total	44	190	~250
Certificates	15	95	~130

website: <http://cyclotron.tamu.edu/smp>

Generation of Electrical Energy by Nuclear Fission and Other Phenomena



Organization: University of Dallas
Contact: Prof. Sally Hicks, hicks@udallas.edu
Grade Level: 3-5
Funding source: DOE-NEUP

A nuclear physicist from the University of Dallas has participated in STEAM Career Day at Stipes Elementary in Irving, TX. The focus of her presentations in 2013 and 2014 was nuclear energy generation in fission reactors and general energy production. Four classes of 3rd graders (2013) and 5th graders (2014) were introduced to hand-held generators and what happens in a fission reactor to generate electricity. They also viewed a little quantum physics by viewing spectral tubes through diffractive glasses. Additionally, time was spend encouraging students to take as much mathematics and science as possible at the different levels of their education. Stipes Elementary has a largely Hispanic student body.

5th graders at Stipes Elementary observe neon spectral lines during STEAM Career Day.



Art 2 Science

Organization: University of Notre Dame / Michigan State University
Contact: JINA Outreach, (574) 631-5326, jinaout@nd.edu
Grade Level: 2-12
Funding source: NSF

Art 2 Science Camp is a summer science program for students between the ages 8 and 17 years old, where students over 14 serve as junior counselors. The camp is an extension of our after-school program of the same name which introduces children to the wonders of the physical universe. This camp utilizes a multidisciplinary approach to learning, incorporating reading, writing, music, art and science. Participants learn about physics, astronomy, and other sciences through reading books, creating art, dancing, and hands-on activities.

The camp is continually evolving from both the administration side and the educational content. We have added a number of community partners since the camp's debut in 2011 including a variety of centers and departments at ND, Snite Museum, DPAC, and St. Joseph County Parks. In 2013 and 2014 the Director of Outreach and Education for the NASA Planck Mission joined us to teach physics through dance. Based on this success, we're decoupling a Science 2 Theater camp for older students next year.

We also extended the camp to Lansing for 2014 through a partnership with Union Missionary Baptist Church and Next Young Phenom, Inc.



website: <http://www.jinaweb.org/outreach/artCamp/>

Classroom Support

Organization: University of Notre Dame / Michigan State University
Contact: JINA Outreach, (574) 631-5326, jinaout@nd.edu
Grade Level: K-12
Funding source: NSF

Classroom Support Materials (Formerly Mini-Grants) (K-12) are geared toward curriculum enhancement, providing science teachers with the opportunity to acquire supplementary teaching materials appropriate to nuclear astrophysics. Teachers apply for support online, indicating their list of materials and identifying how they relate to nuclear astrophysics, and how these materials are intended to impact their instruction. JINA purchases the approved materials and has them shipped directly to the school. Often support is related to instructional materials that are introduced in PAN or other JINA outreach programs, enabling teachers to effectively apply their experiences with JINA in their classrooms. During the past year, there has been a sharp increase in educator interest regarding the marble nuclei materials. Some have been introduced through science expos or PAN, but many have learned of the lessons and activities through 2nd or 3rd hand-knowledge after teachers take the materials to their own local science fairs and expos.



website: <http://www.jinaweb.org/html/jinaprograms.html>

Nuclear Pipeline

Organization: University of Notre Dame / Michigan State University
Contact: JINA Outreach, (574) 631-5326, jinaout@nd.edu
Grade Level: 2-12
Funding source: NSF

The variety of programs targeted at different ages of youth has developed into a “**JINA Pipeline**” for students to progress through different levels as they gain experience. After recognizing this, we are actively trying to cultivate the pipeline and keep in touch with participants in between programs when possible. Many of our student participants stay involved with JINA through more than one program. The programs for middle school students have been “feeding” the programs for high school students for the past few years. For example, 2 of the 2012 PAN students had previously taken the course on nuclear astrophysics through the MST program at MSU. Many students who attend one PAN program apply to attend another at a different location. Previous PAN teachers recommend interested students to PAN. We recruit local PAN graduates to participate in outreach efforts, including mentoring younger students. The new initiatives for elementary students are also beginning to “feed” the middle school programs.

Current example: At PAN @ ND 2014, the male dorm counselor participated in JINA's Sensing Our World (now organized by another entity), PIXE-PAN, PAN@MSU, and helped with a variety of outreach prior to this summer. He will also be an adult counselor at this summer's Art 2 Science Camp. One of our campers attended PAN@MSU last year and another attending PAN@IMSA earlier this year. A 3rd, local student, was a Junior Counselor at Art 2 Science Camp last year.



website: <http://www.jinaweb.org/html/jinaprograms.html>

Smashing and Detecting Particles



Organization: Brookhaven Laboratory, Office of Educational Programs
Contact: Bernadette Uzzi, buzzi@bnl.gov
Grade Level: Middle/high school
Funding source: DOE Office of Science, Brookhaven Science Associates, NSF

Brookhaven Lab's science educators run a series of programs at the Lab and in local schools to introduce middle/high school students to technologies and principles essential to explorations in nuclear physics. This year, 104 students participated in a one-hour program to learn about particle detection by assembling cloud chambers and analyzing trails left by cosmic rays. Another 84 took part in experiments to assemble a model linear accelerator analogous to one at the Relativistic Heavy Ion Collider (RHIC). Students experimented with the arrangement of magnets to propel steel marbles down a straight track and launch them into a fixed target and head-on collisions. They also learned about accelerator applications from exploring the nature of matter to developing cancer therapies.

The Lab also hosts students for weeklong summer courses. 37 high school students attended this year to learn about RHIC and other experiments that seek to understand matter at the dawn of time and the origin of mass, as well as dark matter, dark energy, neutrinos, and the matter/antimatter asymmetry in the universe. The course for middle school students—focused on the science behind cutting-edge breakthroughs in engineering—served 34 students. Through structural design, circuit construction, and experiments with electromagnetism, students learned how scientists and engineers work together to design and build charged coupled devices, particle detectors, and linear accelerators. Summer program students also toured RHIC facilities. As one student said, "It was valuable seeing the actual locations where the work is done."



websites: <http://www.bnl.gov/stakeholder/summersundays.php>
<http://www.bnl.gov/stakeholder/tours.php>



Future Physicists of Florida

Organization: Florida State University
Contact: Paul Cottle, pcottle@fsu.edu
Grade Level: Middle, High School
Funding source: Florida State University

Moving the needle on the number and diversity of engineers and physical scientists educated in the US will require us to capture students – particularly girls and members of minority groups – before they leave the science and engineering pipeline in high school. Future Physicists of Florida is an honor society that inducts students who show mathematical promise in middle school, usually in an Algebra 1 class. In the fall of 2014, students from five middle schools in four cities (Jacksonville, Orlando, Pensacola and Tallahassee) were inducted in ceremonies at FSU and the University of West Florida. Faculty members follow up with visits to participating schools in the spring to encourage students to pursue the challenging high school math and science programs necessary to properly prepare for college majors in engineering and the physical sciences.



website: <http://futurephysicistsflorida.wordpress.com/>

BEAMS



Organization: Jefferson Lab
Contact: Jan Tyler
Grade Level: 5th, 6th, 8th Students
Funding source: Jefferson Lab

The BEAMS — Becoming Enthusiastic About Math and Science — program is a partnership involving Jefferson Lab and Newport News City Public Schools that supports inner-city students as they progress from the 5th to the 6th and 8th grades. These students and their teachers visit Jefferson Lab for periods of two to four days for science and math activities conducted by scientists, engineers and technicians. The goals are to increase the representation of minorities and women in the science and engineering workforce, to motivate and strengthen students' academic preparation, and to provide teachers with classroom activities based on science and technology. In FY 2014, the BEAMS program involved 1,275 students.



website: <http://education.jlab.org/indexpages/teachers.html>

Nuclear Science Day for Girl Scouts & Boy Scouts



Organization: Nuclear Science Division LBNL
Contact: Alan Poon, AWPoon@lbl.gov, 510-495-2467
Grade Level: 7-12
Funding source: LBNL and supporting funds from foundations

The Nuclear Science Division at LBNL has been hosting the Nuclear Science Day for Girl Scouts and Boy Scouts event annually since 2011. About 200 youths, along with leaders, come to this event each year. Girl Scouts and Boy Scouts in the San Francisco Bay Area learn about the ABC's (alpha, beta and gamma) of Nuclear Science and participate in a number of exciting and educational activities.



The participants have opportunities to construct atomic models, build a simple electroscope, use survey meters to look for hidden radioactivity, tour an accelerator, and also discuss career options with guest scientists. In addition to using Geiger counters in the survey activities, the scouts saw other types of radiation detector in action as well.



Upon completion of the day's activities, all participants get the event patch. Boy Scouts who also complete a prerequisite worksheet will earn the Nuclear Science Merit Badge. This is a very popular community event, and NSD was honored with a community partnership award by a local scout council in 2013.



website: <http://nuclearscienceday.lbl.gov/>

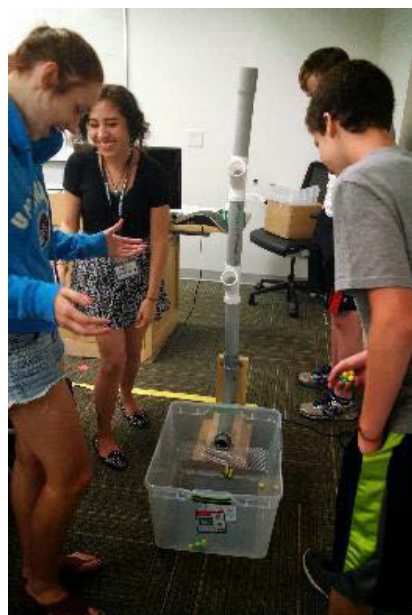
Learn Nuclear Science with Marbles – Lessons & Activities



Organization: Michigan State University
Contact: NSCL/JINA outreach, visits@nscl.msu.edu, 517-908-7363
Grade Level: 6-12
Funding source: MSU/NSF

Modeling nuclei and their reactions with magnetic marbles is an easy way for students to get “hands-on” experience with nuclear science. This model has been adapted for a series of lessons and activities that are appropriate for the classroom and many other venues.

Over 150 teachers have been trained to use these tools, while another 150 have downloaded the materials available freely online. Teachers indicate that this teaching tool is one of the most useful takeaways from their visit to NSCL.



website: <http://www.jinaweb.org/outreach/marble/>

Nuclear Astrophysics for MST@MSU



MICHIGAN STATE
UNIVERSITY

Organization: Michigan State University
Contact: NSCL/JINA outreach, visits@nscl.msu.edu, 517-908-6363
Grade Level: 7-9
Funding source: Participant fees

The Math, Science, and Technology Program (MST@MSU) is a two-week residential summer program for academically talented students currently in the seventh and eighth grades. It gives them a chance to dig into some exciting science classes in a college environment. Each day the students take two two-hour classes in astronomy, physics, mathematics, computer science, chemistry, or environmental science. The JINA/NSCL-sponsored Nuclear Astrophysics course concentrates on spectroscopy, nucleosynthesis, and cosmic rays.

Students reported better understanding of the work involved in a research career, more interest in learning physics and greater motivation to pursue physics as a career.



website: <http://www.nscl.msu.edu/public>

Catch a Cosmic Ray

Organization: Michigan State University
Contact: JINA Outreach, (574) 631-5326, jinaout@nd.edu
Grade Level: 7-12
Funding source: NSF

Catch a Cosmic Ray offers high school tour groups the opportunity to delve into the problem of cosmic rays with a hands-on experiment, form their own hypotheses on the nature of cosmic rays, and test them with directional detectors. This program includes materials for the teacher to use in class before and after visiting NSCL, turning it into a three-day lesson.



website: <http://www.jinaweb.org/html/jinaprograms.html>

Nuclear & Particle Physics at Ohio University



Organization: Ohio University
Contact: Carl Brune, brune@ohio.edu, (740) 593-1975
Grade Level: 7-17 years old
Funding source: INPP

Young Scholars OHIO

Each year we participate in a two-day workshop for highly gifted students where we highlight research and creative activity at Ohio University. Students and parents attend mini-workshops and participate in activities including a tour of the **Edwards Accelerator Lab** where ongoing research activities are explained to the students.

Faculty members from the **Institute of Nuclear and Particle Physics (INPP)** participate each year. This program is sponsored by Ohio University.

We share our passion to learn about:

stars*novae*supernovae*atomic nuclei *new semiconductor materials *neutron imaging for national security*neutron-induced reactions for future nuclear reactors

"This workshop was life-changing!"
-Young Scholar OHIO participant



website: <http://inpp.ohiou.edu/>

Nuclear Science Lab Field Trips



Organization: University of Notre Dame
Contact: JINA Outreach, (574) 631-5326, jinaout@nd.edu
Grade Level: 7-12
Funding source: NSF

JINA hosted two schools for field trips to the University of Notre Dame during the Spring for Science Days. This program is part of a concerted effort to increase interest in STEM careers among local students in underrepresented groups.

Within the student body at Washington High School, approximately 75% receive assistance with school lunches and more than 70% are Hispanic, African American, or multiracial. Although the graduate rate is nearly 90%, less than 40% pass the ISTEP. This year, 75 students participated in the 4th annual JINA field trip for WHS. Students toured the Nuclear Science Lab, saw an astronomy presentation in the DVT, talked about careers in physics, and had a team challenge to build ping pong catapults from household supplies such as craft sticks and rubber bands.

Built on the success of the WHS field trip, JINA has hosted the entire 8th grade class from Jackson Intermediate School for the 2nd straight year. Within their student body, approximately 50% are Hispanic, African American, or multiracial, 70% receive lunch assistance, and 25% are in Special Education courses. In addition to the DVT presentation and nuclear science lesson, the students also participated in the catapult challenge and discussed career options with scientists.

Although the DVT and pizza were the favorites for both groups, post surveys and reflections showed that most students appreciated the entire experience.



website: <http://www.isnap.nd.edu>

Scout Badges

Organization: University of Notre Dame
Contact: JINA Outreach, (574) 631-5326, jinaout@nd.edu
Grade Level: 5-12
Funding source: NSF

JINA has developed a one-day workshop for boy scouts which provides them with all of the information and projects needed to earn their Nuclear Science Merit Badge. So far 4 troops have participated in workshop which includes a tour, building electrosopes and cloud chambers, and lectures on basic nuclear science and career paths. We also often participate in events to facilitate Webelos earning their astronomy badges.

Based on the BSA badge, we have created a girl scout badge, "Getting to Know Nuclear" tailored for young women which covers the same material, but with more societal applications. We held our first workshop for interested girl scouts this fall.



website: <http://www.jinaweb.org/html/jinaprograms.html>

Nuclear Forensics Investigations Summer Science Academy



Organization: Hope College
Contact: Catherine Mader, mader@hope.edu
Grade Level: High school students
Funding source: Mi-ANS, HHMI

Twenty-eight students and four teachers participated in the Nuclear Forensics Investigations Academy at Hope College. The students did hands-on investigations of nuclear science topics in the context of nuclear forensics applications for 5 days during June.

Topics the students explored included:

- Introduction to nuclear forensics
- Radiation safety
- Detecting ionizing radiation
- Common sources of radiation and measuring background radiation
- Factors that affect detection of radiation
- Gamma spectroscopy as a tool to identify isotopes
- Half-life, decay chains, and dating of nuclear materials

The academies were led by Hope College faculty, high school teachers and Hope STEM education majors. Academy participants interacted with current Hope College nuclear science majors over lunch and learned about the various research areas the students are pursuing. In addition, nuclear science faculty also participate in various activities and share aspects of their current research activities.



website: www.hope.edu/csi

Nuclear Forensics Investigations Teacher Workshops



Organization: Hope College
Contact: Catherine Mader, mader@hope.edu
Grade Level: High school teachers
Funding source: AIP, DHS, APS

The goal of the nuclear forensics workshop program is to provide resources to enable high school teachers to teach nuclear science in a real-world context by

- Providing training, materials and equipment to teachers so they can teach nuclear science in engaging ways
- Providing students and teachers with accurate information on radiation safety
- Encouraging students to consider careers in nuclear science, including nuclear forensics

The lessons provide an introduction to a few basic techniques used in nuclear forensics, and motivate student to learn about nuclear science. The topics were chosen based on relevance to the high school science curriculum, accessibility to hands-on experimentation, and overall classroom suitability. Topics include:

- Introduction to nuclear forensics
- Radiation safety
- Detecting ionizing radiation with a GM tube
- Common sources of radiation and measuring background radiation
- Factors that affect detection of radiation
- Gamma spectroscopy as a tool to identify isotopes
- Half-life, decay chains, and dating of nuclear materials



Over the past 7 years, over 100 teachers have participated in workshops ranging in length from 1.5 hours to 16 hours. Over 60 teachers have borrowed equipment kits and utilized the resources provided by the Hope College-led team in their classrooms. Many teachers have borrowed the kit repeatedly over the past 7 years. Several thousand students have been impacted by this project since it began.

website: www.hope.edu/csi

Jefferson Lab High School Internships



Organization: Jefferson Lab
Contact: Jan Tyler
Grade Level: High School
Funding source: Jefferson Lab

Jefferson Lab's High School Summer Honors and the High School Honors Mentorship Programs offer work experience in physics and engineering under the guidance of a Jefferson Lab mentor to the highest-achieving high school students in the local area. The summer honors program is a paid internship, while the mentorship is offered three times each year as an unpaid mentorship.

Students present a summary of their projects to the lab's scientific community at a well-attended lab-wide poster session during the final week of the summer programs.



website: <http://education.jlab.org/indexpages/index.html>

JLab Science Activities for Teachers



Organization: Jefferson Lab
Contact: Jan Tyler
Grade Level: Teachers
Funding source: Jefferson Science Associates

Jefferson Science Activities for Teachers (JSAT) allows 5th, 6th, and 8th grade teachers to spend four hours per month, on two different evenings, at Jefferson Lab. Each two-hour session includes a Jefferson Lab science-related activity, project, and/or lecture. Teachers are given the materials necessary to implement new strategies into their classrooms. In addition, each session covers material that will be taught in the teachers' classroom in the current nine-weeks grading period. At the conclusion of the program, each teacher receives 32 recertification points to be applied to their Virginia Teaching License renewal. Sixty upper elementary and middle school teachers participated in FY 2014.



website: <http://education.jlab.org/jsat/index.html>



The Cosmic Connection

Organization: Lawrence Berkeley National Laboratory
Contact: Howard Matis, HSMatis@lbl.gov
Grade Level: High School +
Funding source: DOE

This web site describes a simple cosmic ray detector that can be built by high school teachers and students. This detector can be used to measure the rate, energy and direction of cosmic rays. It can also measure how cosmic rays vary with elevation. In addition, it is a valuable tool to teach elementary measurement statistics. This unit is part of Berkeley Lab's ABC of Nuclear Science online science unit.



Using the information on the web site, many students have built a detector as a senior project and have entered them in science fairs. The web site provides all the information needed to construct the detector.



The Berkeley Lab detector has gone to all of the continents of the world; it even went to the South Pole. It has been flown in balloons. It is a good tool to discuss Einstein's principle of time dilation.



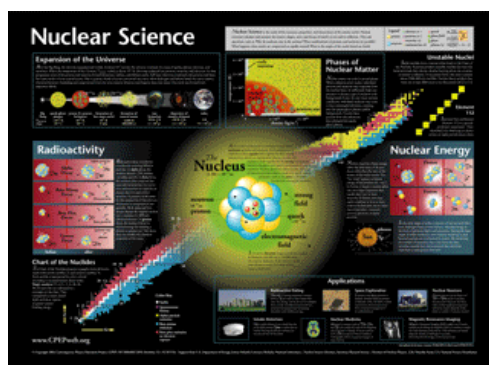
website: <http://cosmic.lbl.gov>

The Nuclear Science Wall Chart



Organization: Lawrence Berkeley National Laboratory / CPEP
Contact: Howard Matis, HSMatis@lbl.gov
Grade Level: High School +
Funding source: DOE

The **ABC's of Nuclear Science** is a brief introduction to Nuclear Science. We look at **Antimatter, Beta rays**, and much more. Visit here and learn about **radioactivity** - alpha, beta and gamma decay. Find out the difference between fission and fusion. Learn about the structure of the atomic nucleus. Learn how elements on the earth were produced.



The website has many resources for teachers and students interested in nuclear science. This includes presentations and a detail guide to nuclear science. A number of activities and experiments are described. There is a section for the Boy Scouts of America Nuclear Science Merit Badge.

The **Nuclear Science Wall Chart** is distributed by the Contemporary Physics Education Project (CPEP) is a world wide, non profit consortium of teacher educators and physicists. The chart explores the structure, properties and interactions of atomic nuclei; it describes basic nuclear processes and the modern picture of the nucleus and then applies them to the formation of the Universe. It illustrates the known isotopes with a chart of the nuclides in graphic form, traces radioactive decay from alpha to gamma and shows how new elements are found. Many nuclear science applications are described. The [CPEP website](http://www.CPEPphysics.org) describes several ways that that that the Nuclear Science Wall Chart can be obtained.

websites: <http://abc.lbl.gov>
<http://www.CPEPphysics.org>

Physics of Atomic Nuclei @ MSU



Organization: Michigan State University
Contact: NSCL/JINA Outreach, pan@nscl.msu.edu, 517-908-7363
Audience: Science Teachers and High School students
Funding source: NSF

Physics of Atomic Nuclei @ MSU hosted 24 high school students and 17 science teachers from around the country in its 21st year. Over the course of two one-week programs, participants attended talks by faculty regarding current research in nuclear science and astrophysics, performed calibrations and experiments with a neutron detector, and presented their findings through a poster session or lesson plan (for the teachers).

Students were expected to evaluate their interest in science/research careers. Significant gains were reported in:

- understanding of what those careers are like and how to prepare for them
- Interest in physics major
- Excitement and confidence for college
- Desire for careers in physics/astronomy

“This program shattered my expectations... I also loved how we got to work with equipment that physicists used as well as interacting with physicists.”

Teachers focused on updating their knowledge and finding ways to incorporate topics in their classrooms. They reported increased interest in and comfort with teaching nuclear science and astrophysics.

“It’s been 20 years since I have thought about nuclear physics this deeply; I like it this time!”



website: <http://www.jinaweb.org/outreach/PAN/>

Professional Development for Teachers



Organization: Michigan State University
Contact: NSCL/JINA Outreach, pan@nscl.msu.edu, 517-908-7363
Audience: Science Teachers
Funding source: NSF

Outreach personnel from NSCL and JINA often attend conferences (or set up individual workshops) to train science teachers who want to incorporate nuclear astrophysics in their curricula.

These professional development events put expertise, equipment and resources in the hands of teachers who directly touch the lives of thousands of students. Maximizing the teachers' interest, comfort and excitement related to nuclear science topics is a very efficient way to connect with many future scientists.



website: <http://www.jinaweb.org/outreach/PAN/>

Physics of Atomic Nuclei @ IMSA



Organization: University of Notre Dame
Contact: JINA Outreach, (574) 631-5326, jinaout@nd.edu
Grade Level: High School
Funding source: NSF

The **Physics of Atomic Nuclei (PAN@IMSA)** program is held at the Illinois Mathematics and Science Academy in Aurora, IL during their intersession week, and modeled after the programs at MSU and ND. IMSA is a 3 year residential school for students gifted in math and science. Intersession is a chance for students to study new topics taught by alumni and faculty. Choices range from robotics to time travel in science fiction. The students learned nuclear astrophysics through lectures and discovery based experiments similar to the MSU and ND programs. However, since the program doesn't take place at a lab, the experiments are designed with portable detectors. Students learned skills such as soldering and computer-detector interface before assembling their own Geiger counters, which they used to measure the effect of distance on radiation flux. They used an MSU CRD to determine the effect of angle on cosmic ray flux, and used a QuarkNet CRMD to measure the lifetime of the muon and to “discover” time dilation. 40 students have participated over the last 3 years.



website: www.jinaweb.org/outreach/PAN

Physics of Atomic Nuclei @ Notre Dame



Organization: University of Notre Dame
Contact: JINA Outreach, (574) 631-5326, jinaout@nd.edu
Grade Level: High school
Funding source: NSF

Physics of Atomic Nuclei @ Notre Dame (formerly PIXE-PAN) hosted 15 high school students from 9 different states in its 6th year. Over the course of the week, students were presented with lectures by faculty in nuclear physics and astrophysics, performed modern lab experiments in the state of the art Jordan Hall of Science, and presented their findings in a poster presentation to parents and members of the physics department.



The students entered the program with a high interest in science, and nuclear astrophysics in particular, and their interest remained high after. However, gains were seen in their attitudes towards basic nuclear research, and an understanding of what a career in research entails.



"I am really much more interested in nuclear science in general now"

The average score on the knowledge test, which covered lecture material as well as experimental concepts, rose from 47% to 73% after the week-long program. The students also found the program immensely enjoyable.



"Learning with a group of peers interested in science the way I am was one of the best educational experiences I've had so far"

website: www.jinaweb.org/outreach/PAN_ND/



Richmond Physics Olympics

Organization: University of Richmond
Contact: C. Beausang
Grade Level: High School
Funding source: University of Richmond

To stimulate interest in physics among high school students and to provide support for physics teachers in the region, the Department of Physics organizes an annual Physics Olympics competition. The daylong event is held on campus; inside, outside and around the Science Center on a Saturday in the spring, once the weather gets nice! The Richmond Physics Olympics has run annually since 2005. Each year we attract 60-100 high school students and teachers from schools all over Virginia. About 40 Richmond undergraduates help staff the event each year.

The overriding theme of the Richmond Physics Olympics is that 'Physics Is Fun'. The aim is to bring high school juniors and seniors (including inner city and/or underprivileged students) into the university atmosphere for a day. During this time they compete as a four-person team in a variety of physics-based experimental events. A volunteer staff, drawn from the faculty, staff, and undergraduate students of the physics department judges these events. The idea is not to intimidate the students by asking them to solve hard theoretical problems but rather to encourage them to enjoy science by letting them apply common sense ideas, team work and basic physical concepts to make measurements, complete the various events, and win prizes. Our experience is that the participants enjoy themselves while applying basic ideas from physics to real world situations. Hopefully they also learn some new physics while interacting with members of the physics department faculty, staff and students.

The competition takes the form of a pentathlon, consisting of five thirty-five minute events. Each event is a task or simple experiment, which the students perform as a team and for which they obtain a result or measurement. The teams are ranked based on the closeness of their result to the correct one (as defined by the judges!). A physics general knowledge quiz is also held throughout the day. The experimental apparatus is deliberately kept very simple, rarely rising far beyond meter sticks, buckets of water, and batteries (equipment budget each year is only ~\$200). The idea is to encourage innovative thinking and to illustrate that, sometimes, quite remarkably accurate measurements can be made using the simplest apparatus. Most of our budget (~\$4000 per year) is spent on tee shirts for all participants, lunch, snacks, and prizes.

Center for Accelerator Science



Organization: Jefferson Lab
Contact: Hari Areti
Audience: Undergrad/Grad
Funding source: Jefferson Lab, Old Dominion University

In 2008, Jefferson Lab partnered with Old Dominion University to found a Center for Accelerator Science in the Physics Department at ODU. The Center offers a spectrum of research opportunities for outstanding undergraduate and graduate students in accelerator sciences and technologies. The students have access to state-of-the-art facilities at both ODU and Jefferson Lab. It has grown to seven professors, two Jefferson Lab professors, one postdoctoral fellow and 11 graduate students with grants totaling \$6.5 million. To date, six students have earned their Ph.D.s through the Center.



website: <http://www.jlab.org/accelerator-center.html>

Majorana Collaboration

Mentoring of Young Members



MAJORANA

Organization: Majorana Collaboration
Contact: Vince Guiseppe, Guiseppe@mailbox.sc.edu
Alan Poon, AWPoon@lbl.gov
Audience: Graduate student and Postdocs

The MAJORANA collaboration has a mentoring committee that consists of two senior and two young (post-docs or graduate students) members of the collaboration's executive committee.

The committee provides career counseling for post-docs; ensures that post-docs participate in the preparation of grant proposals and renewals for Majorana; coordinates with the presentation committee to ensure that junior members present their work at conferences; and organizes mentoring activities during collaboration meetings.

In the past four years, the Mentoring Committee organized the following activities for the young members:

- video conferencing with a member of a faculty search committee to get his insights of the completed search process.
- virtual career planning workshop conducted by a career development professional.
- video conferencing with a recruiter for high-tech start-ups
- "brown-bag lunch" with individuals who have successfully transitioned from a post-doc into a career position in industry or academia.
- "brown-bag lunch" with senior members of the collaboration to discuss outlook of the field, and strategies for getting funding as a junior faculty.

Science and Art Collaborations at the Pratt Institute

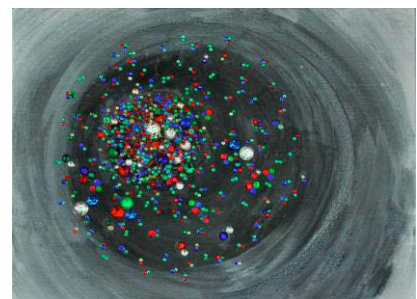


Organization: Pratt Institute
Contact: Ágnes Mócsy, (917) 209-1516, amocsy@pratt.edu
Audience: Undergraduate
Funding source: Partially funded by Brookhaven Science Associates

Since joining the faculty at Pratt Institute in 2008, Professor Mócsy has reached out to Pratt students to form collaborations between artists, designers, film-makers, writers and architects to introduce them to the science of RHIC: "When we make our physics accessible, great things can happen. When physics meets art, really great things can happen." Her vision and these collaborations have produced a variety of highly engaging works that educate and inspire the students, the public, and the scientists.

"Glamorous Gluons" an art exhibit by Sarah Szabo is an example of a notable project: "By creating the artwork, it's a way of better understanding what I learned. It's part of the process; artwork is about my gaining of knowledge. I feel like I can make the art better if I really know what the topic or object is."

So far projects have involved over a dozen Pratt students from a variety of non-STEM fields. The impact on the students has been profound changing the course of their lives: one student became a physics major, and another chose to become a science writer. The impact will continue to spread as these students infected by this enthusiasm for science pursue their interests in diverse fields but with a new perspective and appreciation for science.



website: <http://www.agnesmocsy.com/#!student-collaborations/c10bu>



**Sanford Underground
Research Facility**

Davis-Bahcall Scholars

Organization: Sanford Underground Research Facility
Contact: Peggy Norris, pnorris@sanfordlab.org, (605)-722-5049
Audience: Undergraduate
Funding source: 3M Corporation, NASA SD Space Grant Consortium,
NSF EPSCoR

The Davis-Bahcall Scholars is a program that introduces future STEM professionals from South Dakota – entering college freshmen and sophomores – to modern science and engineering research, with an emphasis on the big physics experiments taking place in underground laboratories.

The annual program, four to five weeks in duration, has variously included international and national travel experiences and extended periods at Sanford Underground Research Facility, Department of Energy national laboratories and research universities. Since 2009, 88 students have participated in the program and more than 40 have now graduated, 95% in STEM fields. Alumni at the program have interned with physics groups at Sanford Lab, University of California Berkeley, Argonne National Lab and University of Notre Dame. At least five graduates are attending graduate school in physics at universities around the country.



website: <http://www.sanfordlab.org>

Research Experience for Undergraduates at Texas A&M



Organization: Texas A&M University
Contact:: S. Yennello
Audience: Undergraduates
Funding source: NSF & TAMU

The Cyclotron Institute has hosted a Research Experiences for Undergraduates programs every year since the Summer of 2004 for approximately 12 students/yr. The REU program provides nuclear science research experiences for those who cannot get them in the normal course of their undergraduate program.

All students engage in nuclear science research projects at the Cyclotron Institute. Additionally the students are exposed to the broader field of nuclear science through weekly faculty lectures. They are informed about career options and societal applications during career day. At the end of the summer the students present their research projects in a Cyclotron Institute symposium and a campus-wide poster session. Additionally many of the students present a poster at the fall meeting of the Division of Nuclear Physics of the APS.

Emphasis is on recruiting students from schools that do not offer these types of research opportunities.



website: <http://cyclotron.tamu.edu/smp>

Nuclear Science at the University of Rochester



Organization: University of Rochester
Contact: W. Udo Schroeder, (585)275-8263,
schroeder@chem.rochester.edu
Audience: Undergraduates, High School
Funding source: DOE, NRC

The University of Rochester (UR) Departments of Chemistry and Physics & Astronomy support basic and applied research in nuclear science. Graduate and undergraduate training includes several lecture courses and the 1-semester advanced nuclear science education lab ANSEL which is offered every year.

The ANSEL provides students with hands-on experience in detection of radiation in our environment, nuclear instruments and methods, and applications in nuclear forensics.

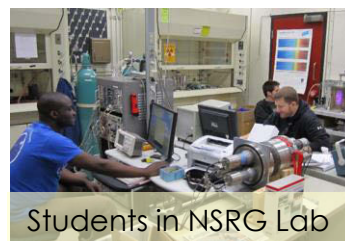
The nuclear science research group (NSRG) conducts an experimental and theoretical research program in basic nuclear science, nuclear and radiation chemistry, and detector development.

The major on-campus nuclear facilities include some of the world's most powerful laser systems Omega/EP at the UR Laboratory for Laser Energetics (LLE). While most of the LLE research and technical R&D focuses on problems associated with laser driven inertial fusion energy, the powerful laser systems are now also employed in novel nuclear science experiments conducted by the NSRG. The experiments use both, laser driven particle beams and thermonuclear plasmas, which are thought to emulate certain stellar environments.

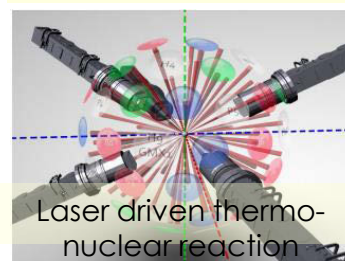
The LLE and, on smaller scale, the NSRG routinely provide research internships for under-graduates and local high schools students.



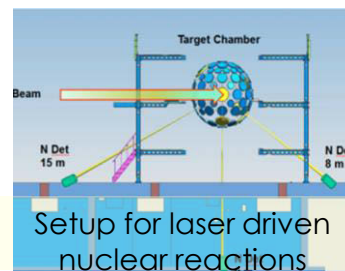
Students in ANSEL Lab



Students in NSRG Lab



Laser driven thermo-nuclear reaction



Setup for laser driven nuclear reactions

websites: <http://nuchem.chem.rochester.edu/index.html>
http://www.lle.rochester.edu/about/education/high_school_program.php

Applied Radiation Physics Certificate Program at UW



Organization: University of Washington
Contact: Alejandro Garcia
Audience: Medical or bioscience systems technicians or engineers,
medical paraprofessionals.
Funding source: University of Washington

Students from our professional and continuing education program and from our evening masters program take this class to get practical training in experimental physics and satisfy their curiosity about nuclear science. They want to learn nuclear physics, from the basics to the applications.

This class is part of a three-quarter program called *Radiation Physics: sources, detection, imaging, and safety* that includes two other sections on imaging and on uses of scintillators.

Lab experience: students tune beam through the accelerator, learn high-vacuum techniques, electronics, accelerator physics. The photo above shows a group of students near a target chamber getting ready to deliver beam. The photo on the left shows a group of students in the process of acquiring data.



website: faculty.washington.edu/agarcia3/phys575/