

Massachusetts Institute of Technology  
American Nuclear Society Student Section

2017 – 2018 End of Year Report

May 1, 2018



## Massachusetts Institute of Technology

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### Section 1. Summary of Section Activities

The Massachusetts Institute of Technology (MIT) American Nuclear Society Student Section expanded efforts in 2017 and 2018 to both foster a better sense of community within the Nuclear Science and Engineering (NSE) department and increase engagement between student section members and the communities around MIT.

This year, the MIT Student Section hosted activities (such as student social or cultural events, department-wide gatherings, intramural sports, NSE Atomic retreat) to help welcome new students into the NSE department, and strengthen social and professional connections between current NSE students. MIT Section organized workshops and programs (such as peer mentoring between prospective/incoming students and current graduate students, graduate student orientation, peer support for the PhD qualifying practice exams) that helped to improve the student experience in the NSE department and enabled student success. The MIT Student Section also advocated for student issues during the biannual department review by the MIT Corporation (MIT's Board of Trustees). The MIT Student Section, based directly on feedback from over 60% of the student body, urged the department to make changes to both the undergraduate and graduate student curriculums, modify the PhD qualifying exam process, and make concerted efforts to recruit and retain a more diverse student population. NSE Department leadership was very receptive to the recommendations and has begun making progress on all of our highest priority recommendations.

The MIT Student Section significantly increased efforts this year to engage with communities outside of the NSE department and MIT. The MIT Student Section organized a half day public outreach event, "Science on Saturday," where 20 students from all nuclear disciplines (including fission, fusion, quantum mechanics, and radiation health physics) presented on-stage demonstrations of nuclear science phenomena to a crowd of over 400 parents and students. Students Section members also created and facilitated hands-on activities to engage with the students of all ages. The Section organized additional small outreach efforts, including displays at the Cambridge Science Festival on radiation and having Student Section members judge local high school science fairs. The Student Section outreach activities also extended beyond science education research; members of the Student Section made several trips to CASPAR, a substance abuse treatment facility several blocks from campus, where they cooked dinner for and talked more with the facility's residents.

The MIT Student Section, in partnership with the MIT Energy Club, sponsored a free public showing to over 100 people of the new documentary *The New Fire* which highlighted the role advanced nuclear could play in the fight against climate change. A panel discussion and Q&A followed the showing with the film's director and two MIT faculty members (Professor Mike Short and Professor Kerry Emanuel) who were featured in the film. The showing brought climate advocates and nuclear engineers together and



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discussions after the film helped correct misconceptions some people may have had about nuclear power and climate change.

With regards to the American Nuclear Society as a whole, MIT ANS made efforts this year to reconnect the Student Section with the national ANS organization. Significant updates and revisions were made to the MIT Student Section bylaws to bring them into compliance with the national guidelines, and have now submitted all of the necessary documents so that the MIT Student Section is in good standing with the national ANS organization. Additionally, we worked with students to apply for ANS graduate fellowships and to learn more about the national ANS organization through more active participation in the Student Sections committee and other ANS Standing Committees.

Overall, the MIT American Nuclear Society Student Section had a busy but incredibly rewarding year. The Section continued to support and improve student experiences within the NSE Department and made new efforts to connect with the community outside of MIT. Our wide variety of social events has been effective at building a strong student body, the university service events are key to the functioning of the NSE department, and the public information outreach events have grown in scope as we look to teach more students and families about nuclear science and engineering. The MIT Student Section continues to be a huge part of student life within the MIT Nuclear Science and Engineering Department and strives to continue to serve the students and community around MIT as a whole.



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### Section 2. Summary of Major Section Activities

This section contains a summary of major events and activities organized by the MIT Student Section. Table 1 lists the events (with brief description), dates, attendance, activity type, and cost of each major event. Detailed descriptions, pictures, and lessons learned for major events and activities are provided in Section 4.

Table 1. Summary of Major Section Events and Activities

Major Section Events and Activities				
Event or Activity	Date	Number of Attendees	Activity Type	Cost
<i>ANS–NSE Buddy Program</i> – Mentoring program between incoming and current graduate students to help their transition into MIT and the NSE Department. Current students email monthly with their buddies over the summer to answer any questions before the incoming students arrive and act as a resource during the first few weeks of the new semester	June – October, 2017	25 current graduate student members, 25 incoming graduate student members	University Service	\$0
<i>NSE Graduate Student Orientation Workshops and Social</i> – MIT ANS organizes and presents both an “unofficial” NSE graduate student orientation (students-only with more honest Q&A) and an “official” orientation with incoming graduate students, faculty, and staff. A social is held after the “unofficial” orientation to help answer incoming student questions and have them meet current graduate students	August 31 – September 1, 2018	25 current graduate student members, 25 incoming graduate student members, 15 members of NSE community (faculty, staff)	University Service, Social	\$500
<i>Liquid Nitrogen Ice Cream Social</i> – Homemade liquid nitrogen ice cream social to welcome students and faculty back for fall semester.	September 5, 2017	40 graduate/undergraduate student members, 10 members of NSE community (faculty, staff),	Social	\$400



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Event or Activity	Date	Number of Attendees	Activity Type	Cost
<i>MIT ANS BBQ &amp; Pub Crawl</i> – Traditional department-wide event at the end of the first week of classes, organized and sponsored by MIT ANS. The BBQ is followed by a pub-crawl of our favorite local spots	September 8, 2017	60 graduate/undergraduate student members, 15 members of NSE community (faculty, staff)	Social	\$300
<i>NSE Atomic Retreat</i> – 3 day retreat at a summer camp in New Hampshire for incoming students to meet each other and get to know current students outside of classes	September 22-24, 2017	40 graduate student members	Social	\$3,000
<i>ANS Steak Fry</i> – Traditional department-wide event at the end of the September organized and sponsored by MIT ANS, featuring 60+ lbs. of steaks	September 28, 2018	85 graduate/undergraduate student members, 25 members of NSE community (faculty, staff)	Social	\$1,000
<i>Interdepartmental Mixer</i> – Public social hosted at the on campus pub with the Graduate Association of Mechanical Engineers	October 30, 2017	85 graduate/undergraduate student members	Social	\$100
<i>MIT NSE Visiting Committee</i> – Advocated for student issues during the biannual department review by the MIT Corporation (MIT's Board of Trustees). Conducted survey students, held town-hall meetings, provided written and oral report to Corporation on areas of improvement (student life, education, etc.) for graduate and undergraduates	September - October, 2017	12 graduate/undergraduate student members,	University Service	\$200
<i>NSE Science on Saturday</i> – Stage demonstrations and hands-on activities to explore magnetism, electricity, nuclear science, and nuclear engineering to students 2th to 12th grade and their families	December 2, 2017	20 graduate/undergraduate student members, 400 general public	Public Information	\$200



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Event or Activity	Date	Number of Attendees	Activity Type	Cost
<i>MIT ANS Mystery Hunt Team</i> - MIT ANS organized a team to participate in the MIT Mystery hunt, one of the largest multi-day puzzle competitions in the country	January 12 – 15, 2018	15 graduate student members	Social	\$50
<i>Australia Day Social</i> – Student lunch social featuring Australian food to celebrate Australia Day	January 26, 2018	50 graduate/undergraduate student members	Social	\$300
<i>PhD Qualification Exams Peer Support</i> – MIT ANS organized practice exams, study sessions, dinner for students preparing to take the PhD qualifying exams	January - February, 2018	40 graduate student members	University Service	\$500
<i>PCSS Science/Eng. Fair</i> – Judging a high school science and engineering fair for a local science focused charter school	February 9, 2018	3 graduate student members	Public Information	\$0
<i>Chinese New Year Social</i> – Student lunch social featuring Chinese dishes to celebrate the Chinese New Year	February 23, 2018	50 graduate/undergraduate student members	Social	\$300
<i>ANS-NE Nuclear Jeopardy</i> – MIT ANS participated in a college Jeopardy competition with the ANS Local Northeast Regional Section. Students from different colleges were mixed on teams and top two teams in the competition had students from the MIT ANS Section.	February 28, 2018	3 graduate student members, 1 undergraduate student members	ANS Support	\$0
<i>PhD Qualification Exams Social</i> – Department social to celebrate students finishing PhD qualifying exam process.	February, 2018	70 graduate/undergraduate student members, 10 members of NSE community (faculty, staff)	Social	\$1,000
<i>CASPAR Dinner</i> – Cooked and served dinner for residents of a shelter and substance treatment center adjacent campus	March 2, 2018; March 30, 2018	10 graduate/undergraduate student members	Community Service	\$1,000



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Event or Activity	Date	Number of Attendees	Activity Type	Cost
<i>Screening of the New Fire</i> – Free, public nuclear documentary screening with post-screening QA Panel featuring the film director and two MIT faculty featured in the film. Presented in partnership with the MIT Energy Club	March 12, 2018	20 graduate/undergraduate student members, 10 members of NSE community (faculty, staff), 80 from outside of MIT	Public Information	\$1,000
<i>NSE Graduate Student Visiting Weekend</i> – Informal social events that allow prospective graduate students to learn more about MIT NSE. Prospective students are paired with current students in their research area to answer specific questions. Prospective students are given tours of NSE labs, experimental fusion facilities, and the MIT reactor	March, 2018	25 current graduate student members, 25 prospective graduate students	University Service, Social	\$400
<i>Cambridge Science Festival</i> – Hands-on public demos of radiation using cloud chambers, Geiger counters, and shielding	April 14, 2018	7 graduate student members, 3,000 general public	Public Information	\$50
<i>MIT ANS End of Year Banquet and General Body Meeting</i> - Traditional department-wide event in May celebrating department achievements, organized and sponsored by MIT ANS. New MIT ANS Section officers are elected at this meeting.	May 14, 2018	85 graduate/undergraduate student members, 25 members of NSE community (faculty, staff) <i>[expected]</i>	Section Management, Social	\$5,000
<i>Yellowcake BBQ</i> - Traditional department-wide event in May (on the last day of classes) organized and sponsored by MIT ANS. The event features both yellow (sheet) cake and catered BBQ.	May 17, 2018	85 graduate/undergraduate student members, 25 members of NSE community (faculty, staff) <i>[expected]</i>	Social	\$2,500



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Event or Activity	Date	Number of Attendees	Activity Type	Cost
<i>Faculty Meeting Participation</i> – The MIT ANS Co-Presidents (and the MIT ANS Undergraduate Chair when appropriate) participate in all NSE Department Faculty meetings to ensure that student prospective on department is included in faculty decision making processes	Monthly, Fall 2017 – Spring 2018	2 graduate student members	University Service	\$0
<i>ANS Seminar Series</i> – Invited seminar talks with speakers on nuclear engineering topics, ranging from operation of Palo Verde Nuclear Generating Station to isotopic separation to fundamental materials research.	Various dates, Fall 2017 – Spring 2018	Average of 30 graduate/ undergraduate student members, 5 NSE faculty, 5 other MIT affiliated	Professional Development	\$1,500
<i>ANS Seminar Lunches</i> – MIT ANS members have lunch with invited seminar speakers to both network and to gain personal insights from the speakers on research and professional opportunities.	Various dates, Fall 2017 – Spring 2018	Average 5 graduate/ undergraduate student members per dinner	Professional Development	\$1,500
<i>Undergraduate Professional Development Dinners</i> – Small group undergraduate-only dinners with seminar speakers to provide a relaxed environment for networking and to learn more about professional engineering opportunities	Various dates, Fall 2017 – Spring 2018	Average 6 undergraduate student members per dinner	Professional Development	\$500
<i>Undergraduate Study Breaks</i> – Undergraduate-only dinners to help students relax during midterm weeks and help encourage a sense of community among undergraduate students	Various dates, Fall 2017 – Spring 2018	20 undergraduate student members	Social	\$1,000





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Event or Activity	Date	Number of Attendees	Activity Type	Cost
<i>Political Advocacy</i> – Various MIT ANS members have participated in organized political advocacy efforts on many topics, including climate change, advanced reactors, clean energy, and nuclear engineering education funding	Various dates, Fall 2017 – Spring 2018	5 graduate/undergraduate student members	Public Information	\$0
<i>MIT ANS Intramural Sports</i> – MIT ANS participation in a wide range of intramural sports including soccer (indoor, outdoor), flag football, hockey, volleyball, softball, and basketball.	Fall 2017 – Spring 2018	30 graduate/undergraduate student members	Social	\$300



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### Section 3. General Section Information

This section contains updated information for the MIT American Nuclear Society Student Section including general Section information (Table 2), advisor contact information (Table 3), outgoing Section officers (Table 4), incoming Section officers (Table 5), and Section financial information (Table 6).

Table 2. General Section Information

Section Information		
Section Name:	Massachusetts Institute of Technology	
Section Mailing Address:	24-214, 77 Massachusetts Ave	
	<i>Street</i>	
	Cambridge	MA 02139
	<i>City</i>	<i>State Zip</i>
Section website:	<i>n/a</i>	
Facebook page:	<i>n/a</i>	
Section email:	ans-board@mit.edu	
No. of Section Members:	28	105
	<i>Undergraduate</i>	<i>Graduate</i>
NE Department Enrollment:	~30	~100
	<i>Undergraduate</i>	<i>Graduate</i>
Dues Required of Members:	\$0	<i>n/a</i>
	per	<i>Year, Month, etc.</i>

Table 3. Department Advisor Information

Advisor Information		
Name:	Prof. Benoit Forget	
Email:	bforget@mit.edu	Phone: 617-253-1655
Mailing Address:	24-214, 77 Massachusetts Ave.	
	<i>Street</i>	
	Cambridge	MA 02139
	<i>City</i>	<i>State Zip</i>



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Table 4. Current (Outgoing) Officer Information

Outgoing Officer Information			
Position	Name	Email	Year and Major
Co-President	Guillaume Giudicelli	g_giud@mit.edu	Graduate Student, NSE
Co-President	Patrick White	rpwhite@mit.edu	Graduate Student, NSE
Public Information Officer	Travis Labossiere-Hickman	tjlaboss@mit.edu	Graduate Student, NSE
Treasurer	Yifeng Che	yfche@mit.edu	Graduate Student, NSE
Undergraduate Chair	Kayen Yau	kayenyau@mit.edu	Senior Undergraduate Student, NSE
Social Chair	Rachel Parus	rparus@mit.edu	Senior Undergraduate Student, NSE
Social Chair	Sterling Harper	smharper@mit.edu	Graduate Student, NSE
MIT Graduate Student Council Representative	Lucas Rush	ltrush@mit.edu	Graduate Student, NSE
MIT Graduate Student Council Representative	Thomas MacDonald	tdmacd@mit.edu	Graduate Student, NSE
Athletics Chair	Jayson Vavrek	jvavrek@mit.edu	Graduate Student, NSE
Immediate Past Co-President	Cody Dennett	cdennett@mit.edu	Graduate Student, NSE
Immediate Past Co-President	Pablo Ducru	p_ducru@mit.edu	Graduate Student, NSE

Table 5. Incoming Officer Information

Outgoing Officer Information			
Position	Name	Email	Year and Major
Co-President	N/A – 2018/2019 ANS Officers are elected at the General Body Meeting and Spring Banquet on May 14 <sup>th</sup> , 2018.		
Co-President			
Public Information Officer			
Treasurer			
Undergraduate Chair			
Social Chair			
Social Chair			
MIT Graduate Student Council Representative			
MIT Graduate Student Council Representative			
Athletics Chair			
Immediate Past Co-President			
Immediate Past Co-President			



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Table 6. 2017 – 2018 Section Operating Budget and Expenditures

<b>Section Financial Information</b>	
<b>Section Funding Source</b>	<b>Amount</b>
MIT Department of Nuclear Science and Engineering	\$ 25,000.00 <sup>(Note 1)</sup>
Section Dues	\$ 0.00
MIT Graduate Student Council	\$ 600.00
Total Section Funding:	\$ 25,600.00
<b>Authorized Section Expenditures</b>	<b>Amount</b>
Department Wide Events Sponsored and Organized by Section (1 Major Fall Semester and 1 Major Spring Semester Event)	\$ 9,000.00
Graduate Orientation and Student Retreat	\$ 3,500.00
Fall 2017 Seminars (Seminar refreshments, speaker lunches with current students)	\$ 1,000.00
Spring 2018 Seminars (Seminar refreshments, speaker lunches with current students)	\$ 3,000.00
Fall 2017 Social Events	\$ 2,000.00
Spring 2018 Social Events	\$ 1,000.00
Undergrad Social Events and Professional Mentor Lunches	\$ 2,000.00
PhD Qualification Exam Mentoring Program and Socials (Practice exams for students, dinner for test takers, results social)	\$ 1,500.00
Community Outreach and Volunteering Event (Cambridge and Somerville Program on Alcohol Rehabilitation [CASPAR])	\$ 1,000.00
Intramural Sports and Social Events	\$ 400.00
Additional Miscellaneous Outreach Events:	\$ 300.00
Other Expenditures	\$ 900.00
Total Section Expenditures:	\$ 25,600.00

Note 1: Final department funding will be confirmed June 1 pending final tally and justification of Section expenditures



## Section 4. Detailed Descriptions of Selected

This section contains detailed descriptions of selected major events and activities organized by the MIT Student Section, and provides best practices and lessons learned. Table 7 organizes the MIT Student Section by types and lists which events were selected for detailed summaries.

Table 7. Categorization of MIT Section Events

List of Major Section Events and Activities		
Event	Type	Detailed in Section
ANS Seminar Series	Professional Development	4.1
ANS Seminar Lunches	Professional Development	4.2
Undergraduate Professional Development	Professional Development	4.3
NSE Science on Saturday	Public Information	4.4
Screening of the <i>New Fire</i>	Public Information	4.5
Cambridge Science Festival	Public Information	4.6
PCSS Science/Eng. Fair	Public Information	-
Political Advocacy	Public Information	4.7
ANS-NE Nuclear Jeopardy	ANS Support	4.8
CASPAR Dinner	Community Service	4.9
ANS–NSE Buddy Program	University Service	-
NSE Graduate Student Orientation Workshops	University Service, Social	-
NSE Graduate Student Visiting Weekend	University Service, Social	-
PhD Qualification Exams Peer Support	University Service	-
Faculty Meeting Participation	University Service	-
MIT NSE Visiting Committee	University Service	-
MIT ANS End of Year Banquet and General	Section Management, Social	-
NSE Atomic Retreat	Social	4.10
ANS Steak Fry	Social	4.11
Yellowcake BBQ	Social	-
ANS Orientation BBQ and Pub Crawl	Social	-
PhD Qualification Exams Social	Social	-
Undergraduate Study Breaks	Social	-
Liquid Nitrogen Ice Cream Social	Social	4.12
MIT ANS Mystery Hunt Team	Social	-
Australia Day Social	Social	-
Chinese New Year Social	Social	-
Interdepartmental Mixer	Social	-
MIT ANS Intramural Sports	Social	-



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### Section 4.1. ANS Seminar Series

The MIT Student Section organizes seminar talks on a wide variety of different topics relevant and interested to students within the department. Table 8 provides a summary of this year's invited ANS Seminar speakers and presentations. The MIT ANS Co-President also helped schedule meetings for the seminar speaker with NSE department faculty to foster collaborations.

Table 8. MIT ANS Seminar Speakers with Seminar Topics

2017-2018 ANS Seminar Speakers			
Date	Speaker	Organization/Affiliation	Seminar Topic
September 8, 2017	Dr. Hendrik Strydom	Klydon (Pty) Ltd.	Novel methods for isotopic separation
November 27, 2017	Prof. Hongjie Xu	Chinese Academy of Sciences	Development of thorium-fueled molten salt nuclear reactor designs in China
December 4, 2017	Prof. Frank Garner	Texas A&M University	Reactor component material irradiation and testing
February 12, 2018	Prof. Janelle Wharry	Purdue University	Nano-mechanical testing of irradiated materials
March 5, 2018	Dr. Lindsey Gilman	Exponent Consulting	Root cause failure investigation of the San Onofre Nuclear Generation Station steam generators
April 2, 2018	Mr. Bradley Sutton	Arizona Public Power, Palo Verde Nuclear Generating Station	Commercial reactor core design, plant operations
April 9, 2018	Prof. Andrew Osborn	Colorado School of Mines	Neutronic simulations of the traveling wave reactor core
April 30, 2018	Dr. David LeBlanc	Terrestrial Energy	Development of the Terrestrial Integral Molten Salt Reactors (IMSR)
May 7, 2018	Prof. Jenifer Shafer	Colorado School of Mines	Nuclear security and radiochemistry



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Date	Speaker	Organization/Affiliation	Seminar Topic
May 14, 2018	Dr. David Petti, Prof. Jacopo Buongiorno, Prof. John Parsons	Idaho National Lab, Massachusetts Institute of Technology, Massachusetts Institute of Technology	Summary of key findings from the MIT Study "The Future of Nuclear Energy in a Carbon-Constrained World"

The seminars were all considered successful by the Section and had an average attendance of roughly 30 graduate/ undergraduate student members, 5 NSE department faculty members, and 5 students, researchers, or faculty from outside of the NSE department.

One best practice for the seminars was having faculty member nominate specific speakers for ANS Seminars. This helped ensure that the speakers were of the highest quality and that students from the faculty member's group would want to attend the talk, helping ensure good seminar attendance.

One observation about the seminars was that there was found to be no correlation between providing refreshments at the seminar (cookies, coffee, etc.) and attendance. Student members cared much more about the topic of the talk than the free food or drink provided.

One lessons learned was that cross advertising with other MIT departments (e.g., Mechanical Engineering, Material Science, Physics) could be very useful increasing seminar attendance and the impact of these seminars. We are working to improve seminar outreach to other engineering and science departments next year.

### Section 4.2. ANS Seminar Lunches

The MIT ANS Seminar Lunches provided undergraduate and graduate students an opportunity to have additional time to talk with our invited seminar speakers. Lunch was generally capped at 5 students to maintain a small group and ensure that each student would have an opportunity to talk with the speaker. Signup was on a first-come, first-serve basis once the ANS seminar was announced, but exceptions could be made if the speaker's background was particularly relevant to a student's research or future work plans.

The seminar lunches were incredibly successful and are recommended for other sections. The opportunity to have honest talk with experts absent large groups or faculty members is very valuable.

One observation about the seminar lunches is that costs can be easily controlled by selected less costly restaurants or having a lunch delivered to campus at a lower, fixed price per person.



### Section 4.3. Undergraduate Professional Development Dinners

The undergraduate professional development dinners provided undergraduate students an opportunity to talk with invited seminar speakers and focus on the issues most interesting to them. Unlike Seminar Lunches that could be dominated by graduate students and their research, the undergraduate dinners allowed conversation to focus on post-graduate job searches and how to shape early career professional development. The undergraduate professional development dinners were held with Dr. Lindsey Gilman and Mr. Brad Sutton. These speakers were selected because they are both MIT graduates and have been in the work force less than 10 years. This allowed them to provide insights that resonated most closely with the MIT undergraduate students.

We would recommend this activity to other sections if you observe limited participation by undergraduate students with invited speakers or if you would like to create an environment where undergraduate students are more comfortable seeking career advice from high profile seminar speakers.

One best practice to have dinner in a relatively casual environment so that both undergraduate students and the speakers are more willing to open up with honest questions and answers.

### Section 4.4. NSE Science on Saturday Event

Science on Saturday is a monthly program aimed at making Science exciting for students of all ages (K-12). MIT ANS sponsored and organized the NSE Science on Saturday to help teach students and families more about a wide range of nuclear science and engineering topics. The activities consisted of a 1 hour rehearsed stage show and 10 to 15 hands on demonstrations. Roughly 20 undergraduate and graduate members, along with several research scientists from the MIT Plasma Science and Fusion Center, presented to a crowd of 400 students and parents. Demonstrations and activities focused on fun science experiments and tried to help students discover and explain simple concepts, ranging from what is an atom to how much density nuclear fuel contains.

A two-part program (on-stage show and off-stage hands on demos) was extremely effective. The break helped keep audience attention. The on-stage show (with large amounts of audience participation at times) consisted of the following acts:

- Demonstration of magnetostatics using different metals, magnets, and electromagnets
- Operation and experiments using a high voltage plasma discharge tube
- Demonstration of quantum time crystals using audience members 'atoms'
- Testing the UV blocking properties of different sunscreen
- Demonstration of super conducting material properties using liquid nitrogen (and smashing things frozen in liquid nitrogen)
- Creation of plasma pickle – a sodium plasma inside of a pickle by applying high voltage

The off-stage hands on demos included:

- Cloud chamber
- PWR reloading game (attempting to match core loading patterns using long tongs),
- Cross sections attenuation game (shows difficulty of getting ball through a box depending on number and size of atoms in the box)



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- Mock PWR fuel assembly with take-home PWR fuel pellet information cards (next to 3 55-gallon drums to visualize the energy content of one PWR fuel pellet)
- Mock CANDU fuel assembly and mock TRISO fuel pebble
- Shielding demo (Fixed Geiger counter measures how source signal changes depending on distance from source and the types of shielding in between the source and the detector)
- Electromagnet coil demo,
- Marble matching game to illustrate how to build atoms and radioactive decay
- Geiger counters with natural uranium, check sources, and Fiestaware
- Plasma globes

We would be happy to share any schematics and designs for any of the off-stage hands on demos.

Best practices from this year's Science on Saturday include:

- Build a large library of demos slowly by adding 1-2 new demos each year from year to year. Many MIT ANS students had simple demo ideas that don't take long to build and which can be used for multiple shows if constructed with care the first time.
- Go big! People are more impressed with visually interesting demos over demos that are technically sophisticated but visually simple. The goal is getting people to want to learn.
- Keep your presentation simple, but adapt to your public. It is hard to have demos be accessible for very young students and still be interesting to older ones. Have student presenters prepare to give a more or less simplified version of a pitch for their demo.
- Practice your stage show well ahead of time! Allow several weeks to practice and rehearse stage demos, especially if they require any sort of equipment or configuration changes on stage. A well-rehearsed show makes a huge difference.

One final best practice is to partner with a museum or a high school that can email lists of parents in your area and help ensure an interested audience for your activities. Scaling up from a small event can also help you build momentum rather than starting with a large event initially.

Photos of the NSE Science on Saturday:



Figure 1. A student learns about core refueling in a hands-on exercise!

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Figure 2. Kids learn about radiation detection with Geiger counters and Fiestaware



Figure 3. Be safe (and have fun) with on-stage demos that require proper PPE



Figure 4. Explaining the fundamentals of nuclear power to parents and students

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### Section 4.5. Screening of the *New Fire*

MIT ANS, in partnership with MIT Energy Club, hosted a free public screening of the new documentary *The New Fire*. The documentary, produced and directed by David Schumacher, explains how nuclear power may be vital to the fight against climate change and tells the story of three advanced reactor companies working to change the face of nuclear. While the issue of climate change is very important at MIT, few students or faculty members are aware of the role that nuclear power could play in fighting climate change. This event was designed to increase public awareness of nuclear power and help answer public questions about advanced nuclear technologies. The screening was followed by a panel-style Q&A featuring director David Schumacher, and MIT faculty members Kerry Emanuel (Earth, Atmosphere, Planetary Science Department) and Michael Short (Nuclear Science and Engineering Department), both featured in the film. Over 100 people attended the film screening, include approximately 20 MIT ANS members, 10 members from the NSE community and approximately 80 people from the local MIT and Cambridge community.

One best practice was having a panel discussion after the screening. The panel with was very well received and the audience was very engaged throughout the entire 30 minute Q&A. Having an experienced and knowledge moderator was essential. For this event we were able to have Neil Rasmussen, MIT alumnus and son of the famed MIT NSE Professor Norm Rasmussen, direct the Q&A and help spur questions from the audience.

A second best practice we observed during the event was that collaborating with non-nuclear organizations (the MIT Energy Club and the MIT Graduate Student Council) enabled us to advertise the event audiences outside the Nuclear Science and Engineering department. We attribute the large non-nuclear audience at the screening to this collaboration.

Photos of the *New Fire* showing:



Figure 5. Post-film Q&A panel with film director David Schumacher; MIT faculty members Kerry Emanuel and Michael Short; and Neil Rasmussen, member of the MIT corporation, Co-Founder of American Power Conversion Corporation





Figure 6. Close-up view of post-film Q&A panel

#### Section 4.6. Cambridge Science Festival

The Cambridge Science Festival is the largest science festival in the nation. At the beginning of this week long celebration of science is the main event: the Science Carnival and Robot Zoo. MIT ANS sent a group of seven graduate student members to set up hands-on demonstrations of radiation and talk with the public about nuclear science. The hands-on demos consisted of:

- Cloud chamber with natural uranium fragments
- Large pieces of uranium ore with hand-held Geiger counters
- Shielding demo (Fixed Geiger counter measures how source signal changes depending on distance from source and the types of shielding in between the source and the detector)

The demos were arranged in such a way that it let participants:

1. See and conceptualize radiation in the cloud chamber
2. Measure radiation on uranium ore and experience how we measure radiation
3. Learn the basics of radiation protection (time, distance, shielding) with the full shielding demo and discuss any observations or questions with graduate students

These demos (in this particular order) helped the audience connect the lessons from each of the individual demos into a larger lesson about the radiation that exists all around us. We also spent a fair deal of time talking with parents about their knowledge of radiation and the relative risks posed by different radiation sources. The event was very successful and there was a lively crowd around the booth for the full 4 hour event.

One best practice observed during the event was that is a extremely convenient to participate in externally organized science events. External organizers can help guarantee an interested audience and lets you focus time and effort on crafting and perfecting the demos.

A second best practice is to have multiple teams of volunteers and stagger their start times. Four hours of explaining science to kids and parents can be quite tiring, so having second team to provide relief during breaks without shutting down the hands-on demos is extremely useful.

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Finally, be sure to modify your demos based on audience and the event. For a science-focused event, we consciously focused on talking about the science of radiation and did not explicitly talk about nuclear energy unless it came up naturally during conversation. Increased public awareness of radiation science can help improve public perceptions of nuclear power even if it isn't explicitly discussed.

Photos of the Cambridge Science Festival:



Figure 7. Parents are often just as interested as kids in learning about nuclear



Figure 8. Co-President Patrick White and member Isaac Meyer showing radiation with a cloud chamber and how to measure radiation with a Geiger counter



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### Section 4.7. Political Advocacy

Several MIT ANS members have started to take roles in political advocacy for both general science funding related issues and nuclear engineering specific issues. Past MIT ANS Co-President Daniel Curtis is extremely active on local level working with the MIT Graduate Student Council external affairs board and nationally through the American Nuclear Society's Public Policy Standing Committee. In March 2018, MIT ANS members Briana Hiscox and Jeremiah Collins both participated in the Congressional Visit Days program (organized by the MIT Science Policy Initiative). The two traveled to Washington D.C., learned about the legislative process from former Congressional staffers, and had meetings with their Congressional staff members on Capitol Hill to advocate for greater funding for basic and applied scientific research. Finally, MIT has been active with the Nuclear Engineering Student Delegation (NESD). The NESD is a group of 16 students selected to travel to Washington D.C. every July to meet with key stakeholders related to nuclear science and engineering and advocate for the interests of nuclear science and engineering students nationwide. MIT ANS Co-President Patrick White served as a Co-Chair for the 2017 NESD and was selected as the Chair for the 2018 NESD. Several additional current MIT ANS members have applied for the 2018 NESD with Patrick, and will hopefully join him in Washington D.C. in July 2018 to advocate for nuclear issues. There is a growing interest in nuclear political advocacy at MIT and we aim to continue to have at least 3-5 Section members involved in science and nuclear policy at a local and national level.

### Section 4.8. ANS-NE Nuclear Jeopardy

Four MIT ANS students participated in a college Jeopardy competition with the ANS Northeast Regional Section. Students from MIT, University of Massachusetts - Lowell, West Point, Worcester Polytechnic Institute, and Three Rivers Community College were divided into teams of three and competed in various categories of nuclear related trivia. At the end of the evening, the top two teams in the competition each had one student from the MIT ANS Section. Competition was lively and good-natured throughout the evening and was a successful event.

One lesson learned was to specify the education background of participants. It was sometimes a bit unfair to have third year PhD students competing against undergraduate sophomores. Clarifying the target experience of participants could make for a more even competition!

Photos of the ANS-NE Nuclear Jeopardy:

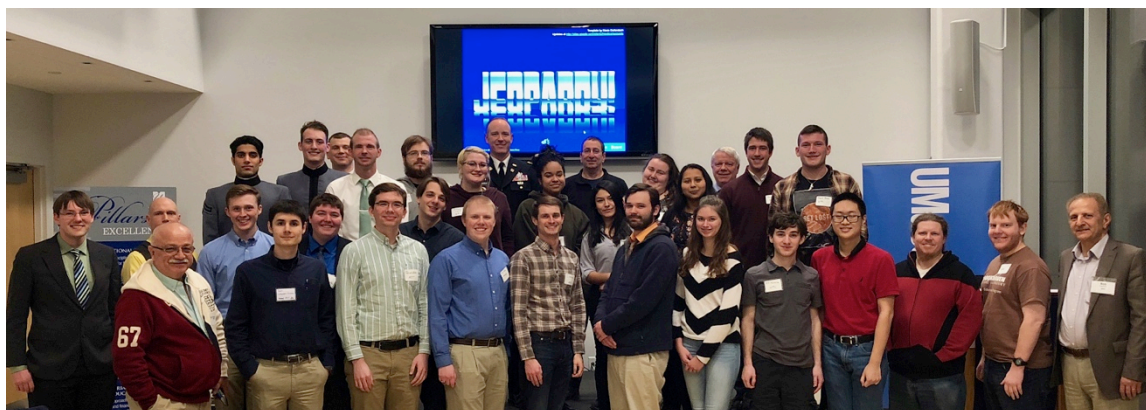


Figure 9. Student competitors and organizers at the ANS-NE Nuclear Jeopardy competition

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Figure 10. MIT ANS students at the ANS-NE Nuclear Jeopardy competition

### Section 4.9. CASPAR Dinner

MIT ANS provides funding and support for students to volunteer at a local substance abuse and homeless shelter, cooking and serving dinner to usually 100 shelter clients. The shelter, CASPAR, is located just down the street from many of the NSE student offices and serves as one of only two homeless shelters Massachusetts that is accessible to people who are currently using drugs and alcohol while homeless. This provides an opportunity for them to access medical and mental health care and counseling services. Volunteering at the shelter provides NSE students the opportunity to engage with and help out the neediest in our local community, but also those people who we may see or interact with on a daily basis. Our recent efforts have focused on devising new menus for CASPAR that are not only scalable to 100+ servings but are also healthy.

Several best practices for these large-scale cooking and volunteer efforts were identified based on several dinners cooked at CASPAR:

1. Continuity in event leadership and planning is critical Previously this was organized by a single person who then recruited a successor when they were ready to move on. However, handoffs between students have sometimes fallen through the cracks. Recently we have shifted to having a small group of 2-4 people who coordinate as a team, with a single person taking the lead on a given event. This allows for visits to continue even when one person is unavailable due to classes or is traveling.
2. Keep track of what meals work and exactly how to prepare them. We have been documenting recent recipes, from the shopping list to cooking and serving instructions for the new healthy meals. Keeping a record of these should ease the burden on new coordinators as they will have the option of using old menus to cut down on planning time.
3. Try to think beyond pasta meals. Normally, organizations that volunteer to cook large meals will cook pasta dishes because they scale easily. One problem is that these dishes

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tend to be high in fat and sugar, and lack protein and vegetables. Work with the facility volunteer coordinator to come up with new meals that are healthy, hearty, and most importantly, taste great.

4. Don't worry about buying too much food to prepare for a dinner. Always aim to have more food than you think is necessary. It will never go to waste at a shelter.

Photos of the CASPAR Dinners:



Figure 11. An assembly line of MIT ANS students working together to get meals out to the dining room



Figure 12. Chicken for 100 people is a lot of chicken



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Figure 13. A busy kitchen as the students prep for dinner



Figure 14. Vegetable prep activities for a huge (and healthy) salad

### Section 4.10. NSE Atomic Retreat

Incoming graduate students from all horizons barely have time to meet each other before the MIT work-storm begins. With this retreat in a summer camp in New Hampshire during the third weekend of school, we bring together incoming students, breaking down walls between domestic and international groups to help form one cohesive class. This retreat occurs after the standard MIT graduate student orientation and NSE Department official orientation activities organized by the MIT ANS Section. The retreat is 3 days, 2 nights with students leaving campus at 6 pm on Friday and arriving back to campus by 12 pm on Sunday. This timeline allowed for students to have a relaxing weekend while still leaving time for homework on Sunday. The retreat was heavily subsidized by MIT ANS (\$3,000) so students only had to pay \$40 per person for the weekend with food, lodging, transportation, and activities. We also allowed students to make

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individual accommodations with MIT ANS if the cost was prohibiting them from attending. The goal of the Atomic Retreat was to allow ALL students in the section, regardless of background or research area, to get to know each other outside of the classroom. It was an incredible success and there is already a great deal of anticipation for next year's Atomic Retreat!

Several best practices observed on the trip included:

- Have organized activities planned with designated leaders, and equipment brought ahead of time or provided by the camp (softball, football, canoeing, canoe-capture the flag, archery, rifle shooting) but allow students flexibility in picking activities (or just let them relax out in nature).
- Have an option for some students to only attend during the day (Saturday) or for just one night (Saturday into Sunday) so increase schedule flexibility and increase attendance.

We observed several things to keep in mind when planning a trip:

- Rifle shooting turned out very fun for both domestic and international students! If you're interested in it, be sure your camp has trained and certified instructors so it is done safely.
- Keep in mind that regulation for water sports can be very strict in some states. In New Hampshire, a lifeguard was required, so we arranged for the camp provide a lifeguard.

Photos of the Atomic Retreat:



Figure 15. The MIT ANS Group Photo on Sunday Morning



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Figure 16. Boarding the canoes before an epic Canoe-capture the flag



Figure 17. Hiking in New Hampshire is the perfect time for passionate discussions about nuclear energy!



Figure 18. US Army vs. France vs. Australia in archery

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Figure 19. Bullseye!



Figure 20. Gathered around the campfire for an evening of games and stories

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### Section 4.11. ANS Steak Fry

The MIT ANS Steak Fry is one of the oldest department-wide traditions. The event is held at the end of the September every year and is organized and sponsored by MIT ANS. Despite the name, no steaks are fried but instead students grill over 60 pounds of steaks from a local butcher shop for the entire NSE community, including graduate and undergraduate students, post-docs, research scientists, faculty, and staff. The ANS Steak Fry is one of the most well attended MIT ANS events with well over 110 members of the NSE community. We highly recommend these types of large, but highly informal, social events. These events can foster a great sense of community within the department and allow for more relaxed conversation between students and faculty. The steak is also a huge draw but one best practice is to order the meat as a bulk purchase from a local butcher. We are normally able to get incredible high quality ribeye and strip steaks from the butcher for less than \$15 dollars per pound.

Photos of the ANS Steak Fry:



Figure 21. MIT ANS Co-President Patrick White serving as a grill master for the ANS Steak Fry



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### Section 4.12. Liquid Nitrogen Ice Cream Social

The Liquid Nitrogen Ice Cream Social was a new social event this year but was based on events done by MIT undergraduate students. We were able to utilize their recipes, safety practices for handling liquid nitrogen, and the cold cooking know-how of an MIT ANS undergraduate student to plan and execute the event. We prepared three flavors of ice cream batter (in a custard form) and then froze batches of the ice cream using liquid nitrogen on demand. The major lesson learned was to reduce the amount of ice cream needed per person. We had planned on over a cup of ice cream per person but the actual amount consumed was under a half cup. Better planning would have resulted in less leftover ice cream batter. Additionally, this event would not have been possible without someone who had previously participated in a liquid nitrogen ice cream event. This was critical in ensuring that the event was safe and successful. We would recommend getting someone with experience with liquid nitrogen cooking if you attempt this event with your Section.



Figure 21. Preparing for the liquid nitrogen ice cream social with proper PPE