LABORATORY UPDATE for ALUMNI

NSCL FRIB

August 2017

FRIB Project in fourth quarter: Eye on future mission of enabling discoveries as civil, technical construction integrate

By Thomas Glasmacher, FRIB Laboratory Director

We are now in the last quarter of our marathon FRIB Project. In March we marked beneficial occupancy of civil construction on our path to completing the FRIB Project, and we had the first of nine planned Accelerator Readiness Reviews in July. Technical installations are also well underway. As we enter the homestretch, we're not only focused on successfully integrating civil and technical construction but we're also thinking beyond the project to the mission of FRIB—enabling scientists to make discoveries.

The DOE-SC Office of Project Assessment reviewed FRIB in June and found that the project is progressing appropriately per the established baseline. At the conclusion of the review, DOE-SC Associate Director of Science for Nuclear Physics Tim Hallman commended the progress that's been made in only a few years since the March 2014 groundbreaking. He said he was "totally impressed" with the tremendous infrastructure now in place and the extraordinary partnership between MSU and DOE. But he reminded that we need to be vigilant and diligent as we approach the finish line.

MSU President Lou Anna K. Simon echoed Director Hallman's kudos, and then urged us to take a moment of pause to recommit to an even better future. She reminded that the project is our commitment to the science community around the world and the science FRIB will enable is the return to the American taxpayers who have invested in it. She described the resolve and commitment of all who work on the FRIB Project as the attitude that happens every day.

We are committed to the vigilance, diligence, and attitude that President Simon and Director Hallman spoke about. In the end the details will all add up to a successful project. We are focusing on those details and maintaining the technique that has brought us to this point in the project.

This issue features many technical milestones we've achieved on FRIB since our last issue.

We will continue to achieve technical milestones as we march to the finish of the FRIB Project. At the same time we are focusing our energy on the things that will affect future FRIB availability and users doing successful experiments—our commitment to the worldwide science community and return on investment to the American people. This is all while we continue to operate the National Superconducting Cyclotron Laboratory, enabling users to conduct ground-breaking research now. Check out the "FRIB science and scientists in the news" in this issue for a glimpse.

DOE-SC Office of Project Assessment review held 27-29 June

The DOE-SC Office of Project Assessment's (OPA) review of FRIB was held 27-29 June. Reviewers are pictured above.

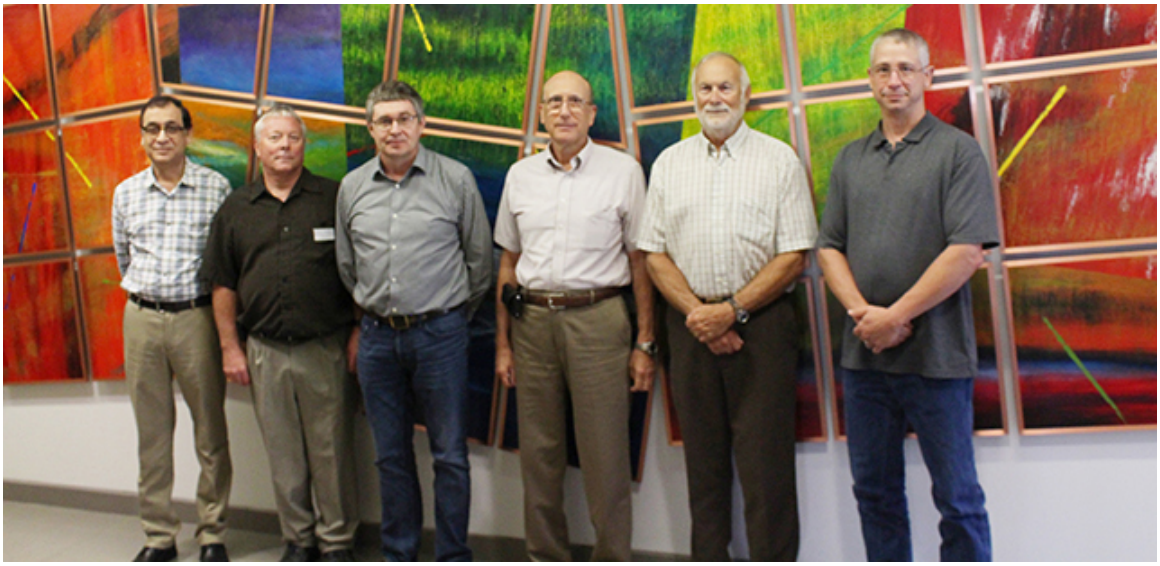
The DOE-SC Office of Project Assessment's (OPA) review of FRIB was held 27-29 June. The main focus of the review was to assess overall FRIB Project progress since the last review in December 2016, with a focus on our technical progress.

The review committee was organized into five subcommittees and FRIB staff gave 53 presentations.

The OPA assessed all aspects of the FRIB Project – technical, cost, schedule, management, and environmental safety and health – and found that FRIB is making appropriate progress toward completion and is well-managed. The review committee answered all charge questions affirmatively.

DOE has tentatively scheduled the next FRIB Project progress review for 5-7 December 2017.

First Front-End Accelerator Readiness Review held 25-27 July



The first Accelerator Readiness Review (ARR) of FRIB was held 25-27 July. Reviewers are pictured above.

The first Accelerator Readiness Review (ARR) of FRIB was held 25-27 July. The purpose of the review was to provide independent input to the FRIB Laboratory Director and the MSU President for their authorization to operate the

accelerator front end (ion source, low-energy beam transport, radio frequency quadrupole accelerator, and medium-energy beam transport) for commissioning with beam.

The review committee comprised six reviewers affiliated with three national laboratories and the review was observed by representatives from Michigan State University, the U.S. Department of Energy, Fermi National Accelerator Laboratory, and the European Spallation Source.

FRIB staff gave eleven presentations on hazards and their mitigation and the readiness of personnel, procedures, programs, and equipment for operation. The review committee found that FRIB is making appropriate progress toward operation and provided a list of eight recommendations to be addressed prior to start.

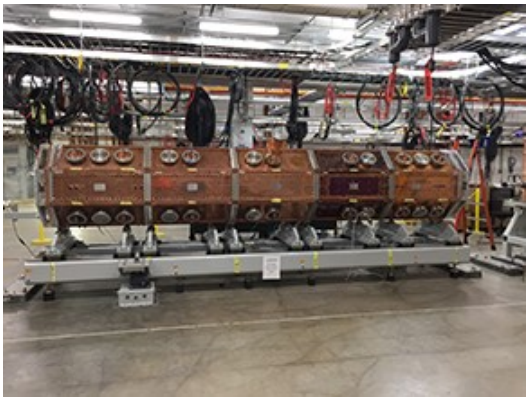
The next ARR, for the accelerator through the first three cryomodules, is scheduled for May 2018.

Technical installation progress advances

With the beneficial occupancy of civil construction achieved, installations of the accelerator components are now progressing. Technical milestones include the completion of FRIB's "front end" – where the ion beam will start – 16 months ahead of schedule. Additionally, 10 of the 49 beam-accelerating cryomodules have been produced, and all major equipment and piping for the cryogenic plant is complete.

This article highlights significant progress since what was featured in our last issue in January.

Radio frequency quadrupole assembled and tuned in tunnel



The radio frequency quadrupole (RFQ) was assembled and tuned in FRIB's linear accelerator tunnel. The RFQ prepares the beam for further acceleration in FRIB's superconducting linear accelerator.

In December 2016, the radio frequency quadrupole (RFQ), part of FRIB's front end, was assembled and tuned in the FRIB linear accelerator tunnel. The RFQ is a critical system of the FRIB linear accelerator, required to run the beam. The energy of the beam produced by FRIB ion sources is too low for the injection into superconducting radio frequency cavities, so the RFQ increases the beam energy from 12 kiloelectron volts/atomic mass unit (keV/u) to 500 keV/u and prepares the beam for the injection into the superconducting linac. The RFQ is a microwave cavity resonator that uses a high-frequency oscillating electromagnetic field to focus and accelerate a low-energy beam of ions.

The FRIB RFQ is a brazed copper structure with a total length of approximately 16 feet, approximately 3 feet wide. To simplify the manufacturing, the structure was split into five segments. Each segment weighs approximately 3 metric tons, together adding up to 15 tons for the whole RFQ. A pair of water skids constantly pumps 300 gallons per minute (GPM) of precisely temperature-controlled water through the RFQ to remove excessive heat deposited on the walls of the RFQ.

Prior to running the beam through the structure, FRIB staff conducted its first Accelerator Readiness Review (ARR) at the end of July focusing on safety and machine readiness.

The demonstration of the beam acceleration in the RFQ is an important milestone for the project, enabling further beam commissioning of the superconducting linac.

First half-wave resonator successfully tested

The first half-wave resonator cryomodule was successfully tested in February, enabling mass production of HWR cryomodules.

In February, the first half-wave resonator cryomodule was successfully tested. Since half-wave-resonators (HWRs) make up two-thirds of the FRIB linear accelerator, the performance of the HWR cryomodules is critical for the project.

The cryomodules contain superconducting radio frequency (SRF) resonators to accelerate the beam and superconducting solenoids to focus it. The resonators and solenoids operate at cryogenic temperatures, hundreds of degrees below room temperature.

The successful completion of the tests on the first HWR cryomodule allowed for the start of mass production of HWR cryomodules for the FRIB linear accelerator, which is the heart of FRIB.

First β=0.041 cryomodule installed on beamline

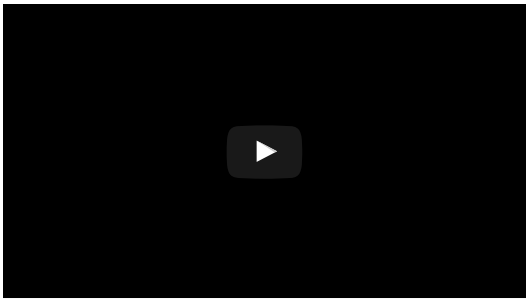
The first FRIB superconducting cryomodule was installed on FRIB's linear accelerator tunnel's beamline in March.

The first FRIB superconducting β=0.041 cryomodule was installed on the beamline in FRIB's linear accelerator tunnel in March. While this was the third cryomodule to be moved to the tunnel, it was the first to be placed on the beamline.

After being lowered through the access shaft, and moved through the tunnel, the cryomodule was inserted into its near-final position and placed on adjustable stands. The assembly and installation of all components and diagnostics for the upper Low Energy Beam Transport (LEBT) line was completed on 6 March. It was then connected to the Advanced Room-TEMperature Ion Source (ARTEMIS).

ARTEMIS was FRIB's first accelerator component to be installed, which took place last year. It is one of two electron cyclotron resonance (ECR) ion sources that FRIB will use to produce ions from elements.

Vertical beamline sections installed



This video shows the installation of the vertical beamline sections.

On 1 May, the first of two vertical beamline sections was installed and aligned in the vertical shaft connecting the front end with the linear accelerator tunnel. The following day, the second section was installed. Each section of the beamline was lifted by a 30-ton capacity crane and moved with precision into the shaft, guided by several FRIB staff.

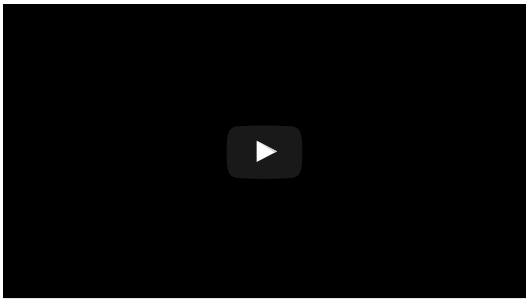
Assembly of the vertical beamline began in January. This section of the accelerator consists of the beamline itself housed by two spaceframes.

The top section measures approximately 13 feet in height, and the bottom measures approximately 14 feet. The frames were assembled first and then the beamline components were installed from the top.

The vertical beamline connects the upper Low Energy Beam Transport (LEBT) to the lower LEBT. The particle beam starts in the upper section of the accelerator, and the vertical beamline transports it to the lower section. This is a critical step in the acceleration of the beamline, as the particle beam must be able to travel from the upper section into the linac tunnel below. Now that both sections have been placed, the vertical beamline will be connected to the upper and lower LEBT.

The installation required coordination and collaboration between the installation groups, vacuum groups, and the alignment team. It marks an important milestone in the construction of the linear accelerator.

FRIB places first matching cryomodule



This video shows the installation of the first matching module.

The first and only β=0.085 matching cryomodule was placed in the linear accelerator tunnel on 17 July.

The matching cryomodule is about half the size of the other cryomodules that will make up FRIB's linear accelerator. While the other cryomodules accelerate the beam, the matching cryomodule bunches up the particles that make up the beam, before sending them to the next section of the beamline. The matching module was cold-tested, or cooled to its operating temperature, successfully before it was moved to the linear accelerator tunnel.

The mechanical and electrical groups are now working on the cryomodule's final alignment and connections of power, controls, and other services.

Annual Nuclear Physics DC Day held 22 May

In the past few years, it has become a tradition for members of the nuclear physics community to participate in a "Nuclear Physics DC Day," where they get the chance to visit with members of their congressional delegations and discuss the importance of nuclear science. This year, the Nuclear Physics DC Day took place on 22 May. Almost 90 nuclear physicists from 28 different states participated with about 25 from the low-energy nuclear physics community. They met with staffers of 57 representatives and 54 senators.

Physicists explained opportunities outlined in the 2015 DOE/NSF Nuclear Science Advisory Committee Long Range

Plan.

The feedback from the meetings was very positive, and the staffers were in general very supportive of basic science research. Such meetings are essential as they show the Congress the direct impact that funding for basic science has on researchers and students from their states and districts.

High-school students participate in NSCL's PAN program

High-school students attended the twenty-fourth PAN program for an intensive introduction to nuclear astrophysics.

The Joint Institute for Nuclear Astrophysics - Center for the Evolution of the Elements' (JINA-CEE) Physics of Atomic Nuclei (PAN) program was hosted at NSCL the week of 24 July.

Twenty-four high-school students participated in the intensive introduction to nuclear astrophysics. Researchers-in-training attended presentations by laboratory faculty and staff before conducting their own experiments on gamma spectroscopy and half-lives.

Attendees were chosen from over 300 applicants from nine states and Spain to experience the life of a nuclear scientist.

Low-Energy Community Meeting held 2-4 August

More than 200 scientists participated in the Low-Energy Community Meeting held 2-4 August 2017 at Argonne National Laboratory.

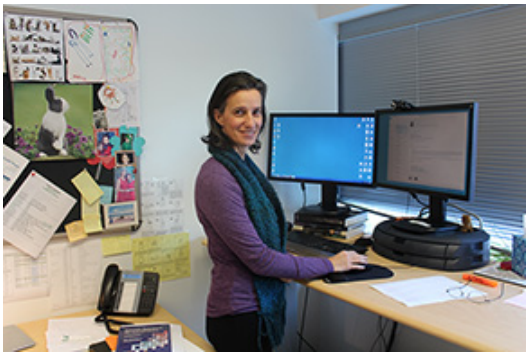
There were 215 participants at this year's Low-Energy Community Meeting, which was held 3-4 August at Argonne National Laboratory. The annual meeting serves as a time for nuclear scientists in the low-energy nuclear physics community to interact and discuss future plans, initiatives, and facilities. The program of the main meeting consisted of plenary sessions and twelve working group sessions. The program with links to the talks can be found on the meeting website.

At the end of the meeting, summaries of the working group sessions were presented, and the following resolutions were accepted unanimously:

- FRIB remains our top priority. The community eagerly anticipates the completion of FRIB and the forefront science this facility will enable.
- Operation of the national user facilities ATLAS and NSCL at optimal levels and strong support for research groups is critical for our field. The ARUNA facilities are a central part of the low-energy science program and their continued operation is crucial. The community strongly supports the funding of these facilities and the associated research.
- The community endorses the prompt initiation and timely completion of the Gamma-Ray Energy Tracking Array (GRETA) construction project, a key instrument for low-energy nuclear science.
- The FRIB Theory Alliance is an essential component of our field. The bridge faculty and theory fellowship positions at universities and national laboratories help to grow capability in this important aspect of our community. We strongly endorse continued support of the FRIB-TA, its programs, and investment in computational theory and related astrophysics.

Five Satellite Workshops were held prior to the main meeting. A half-day workshop on FRIB Day 1 Science included science-based presentations that explored the reach and nature of programs possible with early FRIB beams and the theory in support of those programs. There were three workshops focused on equipment, which included GRETA, the HRS, and a SECAR/JENSA collaboration meeting. Finally, the FRIB Theory Alliance workshop occurred in conjunction with the working group sessions on Thursday afternoon.

Filomena Nunes earns Inspirational Woman of the Year award



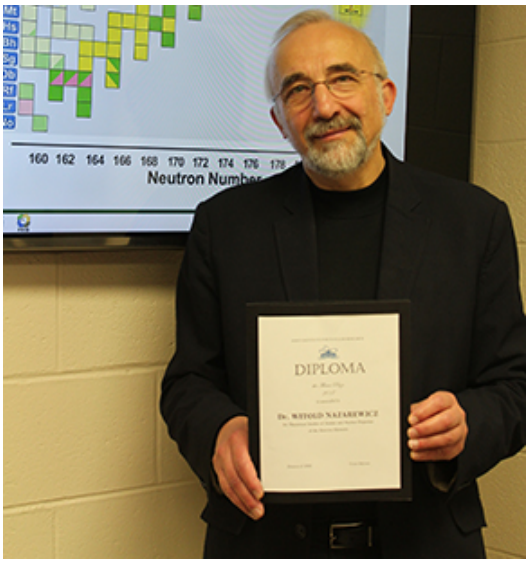
Filomena Nunes, managing director for the FRIB Theory Alliance and professor of physics, received MSU's 2017 Inspirational Woman of the Year Award in the Professional Achievement category.

It is our pleasure to announce that Filomena Nunes has been named as the recipient of the 2017 Inspirational Woman of the Year Award in the Professional Achievement category.

Administered by the MSU Center for Gender in Global Context, the award highlights women who demonstrate integrity, leadership, quality performance, integrative and inclusive action, and influence on campus and in the community.

The selection committee stated that "it is remarkably evident that Dr. Nunes has made significant contributions to the FRIB, her field of study, and all women in STEM. The committee was impressed by her impact on MSU's culture of excellence, but also the impact that Dr. Nunes has had globally."

Witek Nazarewicz receives 2017 Flerov Prize



Witek Nazarewicz recently received the 2017 Flerov Prive for his research work.

Witold (Witek) Nazarewicz, FRIB chief scientist and a John A. Hannah distinguished professor at Michigan State University, received the 2017 Flerov Prize for his research titled “Theoretical studies of the atomic and nuclear properties of the heaviest elements.”

The Flerov Prize is awarded to individuals who make significant contributions to nuclear physics. The award was announced on 16 May in Dubna, Russia, home of the Joint Institute for Nuclear Research (JINR). This prize is given every two to three years in memory of physicist Georgy Nikolaevich Flerov, after whom the 114th chemical element flerovium was named.

Witek’s research focuses on rare isotopes, including superheavy nuclei and the heaviest elements that lie at the current borders of the periodic table. His calculations help clarify their unusual properties. Witek is honored to receive the prestigious award, and said it highlights the benefits of international collaboration in science.

Michael Thoennessen named editor in chief of the American Physical Society

Michael Thoennessen

FRIB Associate Director for User Relations Michael Thoennessen has been named editor in chief of the American Physical Society. The APS editor in chief is responsible for all APS peer-reviewed research journals. Thoennessen will assume the position on Sept. 1.

“Michael Thoennessen has a broad knowledge of physics, extensive leadership experience and the ability to work well with others. He is forward-thinking, especially regarding the future of our journals,” said

Thoennessen is a University Distinguished Professor of physics at MSU. Additionally, he has been deputy executive director of the Nuclear Science and Security Consortium since 2015 and served as supervisory editor of Nuclear Physics A from 2004 to 2016. An APS Fellow, he received the Physical Review Outstanding Referee Award in 2013.

Thoennessen earned his doctorate in experimental nuclear physics in 1988 from the State University of New York at Stony Brook. He served as a research associate at the Joint Institute for Heavy Ion Research at Oak Ridge National Laboratory from 1988 to 1990, before joining MSU in 1990 as an assistant professor.

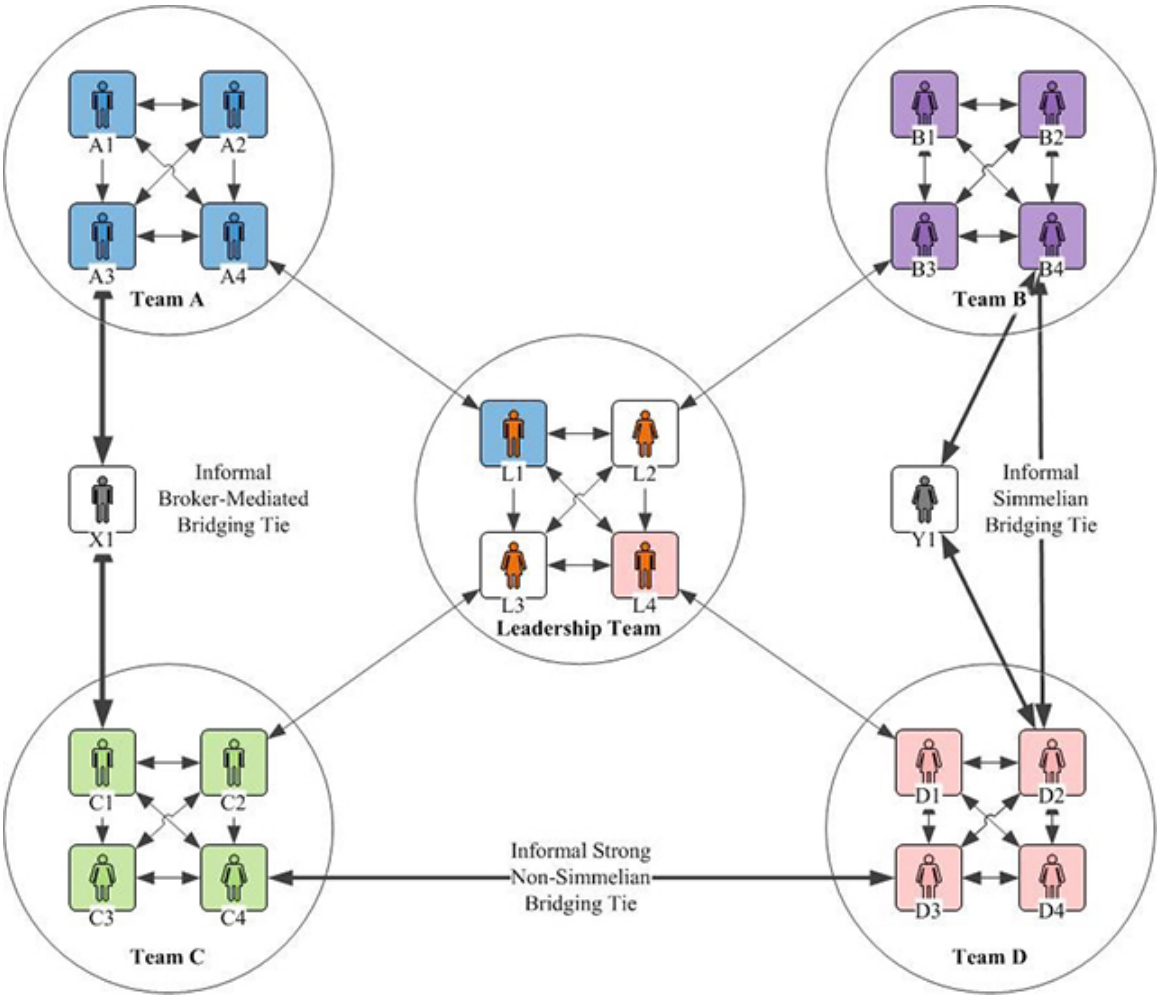
“It is a tremendous accomplishment for Michael to be selected for this prestigious position and speaks to the outstanding physicist and researcher he is,” said Thomas Glasmacher, FRIB Laboratory director. “I am delighted Michael was chosen and confident he will do an outstanding job in this new role.”

Caltech professor of physics and 2011 APS president Barry Barish, who chaired the search committee. “We are very fortunate to have attracted him to become our next editor in chief."

For more information, read the full APS release.

‘Science of Team Science’ Part 3: How does the number and nature of one’s informal ties affect leadership emergence?

By John Hollenbeck, University Distinguished Professor, Eli Broad Professor of Management



A closed tie (sometimes referred to as a Simmelian tie) exists when a third party is linked to both partners of a dyadic informal boundary spanning relationship (forming a triangular structure).

(FRIB has participated in a National Science Foundation “Science of Team Science” Project conducted at FRIB by researchers from the Eli Broad College of Business. Whenever possible, FRIB strives to support other MSU research endeavors, and this is one example. This is the last part of a series that describes the results from the research. Part 2 ran in the last issue of the Laboratory Update for Alumni.)

One of the primary substantive thrusts of the Science of Team Science Project is to discover the impact of “closed” versus “open” configurations of informal ties at FRIB. A closed tie (sometimes referred to as a Simmelian tie) exists when a third party is linked to both partners of an informal boundary spanning relationship (forming a triangular structure). For example, if you are friend of Person A, and also a friend of Person B, this set of ties would be closed if Person A and B were also close friends. The three of you are tied in a very strong way because you relationships with

Person A is reinforced and somewhat constrained by your relationship to Person B. This can be contrasted with direct ties or brokered ties where the links are not “reinforced” in this manner. That is, if you were friends with Person A and B but they were total strangers to each other, then this would reflect an “open” triad.

In this article we discuss how distinguishing between these alternatively structured ties is critical when it comes to predicting leadership emergence in multiteam systems, revealing how closed ties can create opportunities, but also constraints, when it comes to leadership emergence.

Closed ties create unique opportunities when it comes to both social support and access to unique information, but when taken to an extreme they also create unique constraints when it comes to interpersonal flexibility and sub-group polarization. One specific purpose of our study was to examine the potentially disproportional impact of these reinforced Simmelian ties on leadership emergence at FRIB. We proposed and tested the proposition that there is a relationship between the numbers of closed ties and leadership emergence.

The results from our leadership emergence study at FRIB showed that indeed, consistent with past findings, there was no consistent relationship between the sheer number of informal ties and leadership emergence when informal ties were operationalized in terms of open ties. However, when we isolated the closed ties, we found that there was a relationship between the number of Simmelian ties and leadership emergence. A small number of closed ties predicted leadership emergence in both the friendship and advice networks.

In addition, the apex of the curve for the two-different types occurred at a very different value. The apex for friendship ties occurred at roughly four, whereas the same value for the advice network was closer to sixteen. Thus, the two different types network seem to saturate at very different levels which is consistent with the idea that closed friendship ties are more constraining, and that they require higher maintenance relative to advice ties. Thus, when it comes to emerging as a leader in your team, you definitely can have too many closed friendship ties. Leadership often entails making difficult decisions that can upset the kind of tight social network that is characterized by many strong, closed ties. Leaders who are part of open ties systems have more degrees of freedom when it comes to making difficult decisions.

FRIB Laboratory has new online alumni directory form

In an effort to improve the communication with FRIB Laboratory alumni and to better track their career paths, the laboratory has created a new alumni directory form.

Alumni are encouraged to fill this new form by answering a few simple questions. The process should not take more than a couple of minutes.

Going forward, the lab will ask alumni to update their information once a year, to ensure that the data is accurate. Visit the online alumni directory form to enter and update information.

Alumni spotlight: Katie Yurkewicz

writing and medical physics, Katie decided her calling was in communicating rather than practicing science.

In 2005, she took a full-time job in the Fermilab communications office with a focus on scientific computing. The following year, she and Adam headed to CERN laboratory in Geneva, Switzerland, where Katie publicized the participation by 1,700 United States scientists and students—including the MSU

Katie (Miller) Yurkewicz

Katie (Miller) Yurkewicz earned her PhD in nuclear physics from Michigan State University in 2003, under the mentorship of Thomas Glasmacher. Since 2011 she has served as the communication director at Fermilab in Batavia, Illinois.

During Katie's five years as an NSCL and MSU Distinguished Graduate Fellow, she worked with Thomas's Gamma Group to build and test the Segmented Germanium Array (SeGA) and carried out one-neutron knockout and Coulomb-excitation experiments. In the summer of 2002, she traveled to the RIKEN laboratory in Japan to conduct research under the auspices of the NSF East Asia and Pacific Summer Institute. And foreshadowing her future career as a science communicator, Katie traveled several times to Washington, D.C., to advocate for nuclear physics research and volunteered in outreach programs at NSCL.

Immediately following graduation, Katie married fellow MSU graduate student Adam Yurkewicz and moved to Illinois, where Adam carried out his PhD research at Fermilab. After experimenting with both science

ATLAS team—in the Large Hadron Collider particle physics project. In 2011, Katie returned to Illinois to become Fermilab's communication director.

As communication director for a DOE national laboratory, Katie oversees a team of eighteen people who manage Fermilab's employee and user communications, public relations, media relations, community relations, arts and culture, and social media programs. Her team also provides website, photography, graphic design, video, writing, and editing support to the lab.

While a PhD in nuclear physics isn't standard training for a career in communications, it was excellent preparation for Katie. She entered with both an in-depth understanding of the tools and techniques of experimental nuclear and particle physics, and a deep understanding of the culture of physics that has been critical to building trust and good relationships with scientists at Fermilab and around the world. Her experiences working closely with international scientists, both at NSCL and in Japan, were also a great foundation for a communications career spent working with colleagues and partners at CERN and around the world.

When Katie isn't at work at Fermilab or volunteering in the local community she is spending time with her husband and two boys, nine-year-old Eric and two-year-old Leo.

FRIB science and scientists in the news

July 2017

• Tetraneutron calculations by Kevin Fossez et al. published in Physical Review Letters were highlighted by Physics World.

• Morten Hjorth-Jensen was chosen to write a synopsis piece for a recent PRL.

June 2017

• Work done by NSCL user Alan H. Wuosmaa of the University of Connecticut was described in this highlight by the U.S. Department of Energy Office of Science.

May 2017

• Witek Nazarewicz's paper "Challenges in nuclear structure theory" has been selected as a 2016 Journal of Physics G Highlight.

April 2017

• Artemis Spyrou's article in the Journal of Physics G "Emerging Leaders" volume was highlighted by the publisher.

February 2017

• Several outlets featured articles related to Assistant Professor of Physics Chris Wrede's presentation on cosmic detonations at a recent American Association for the Advancement of Science meeting. Among the articles was this one in Scienmag.

News media features FRIB

MSU Road Trip Highlights video features FRIB's Thomas Glasmacher.

• MSU Road Trip Highlights (Thomas is shown from 1:32 to 1:38 in the video)

The MSU communications team featured FRIB in a video about scientific discoveries at MSU.

• Scientific discovery at MSU: FRIB and IQ

Several news outlets published articles about U.S. Senate appropriators advancing a $38.4 billion energy spending bill.

• Senate appropriators advance $38.4 billion energy spending bill

• Senate panel rejects Trump funding cuts on Energy Department programs

Several news outlets published articles about members of the U.S. House of Representatives supporting a full funding request for FRIB.

• House Appropriations Committee meets full $97.2 million funding request for Facility for Rare Isotope Beams

• Bishop, Moolenar applaud efforts to continue full funding for FRIB at MSU

Nuclear Physics News published an article about FRIB, giving an overview of the project.

• Facility for Rare Isotope Beams update

MSU Today published an article about a new study showing FRIB's impact on Michigan's economy and job creation.

• New study shows FRIB significantly impacts Michigan's economy

The Building Tradesman Newspaper published an article about the civil construction work at FRIB.

• A win for nuclear science as FRIB nears construction hurdle

We want to hear from you

Send us your story ideas! Let us know what you are up to!

We want to feature at least one story each issue about you—our FRIB/NSCL alumni, so please email us story tips about you and/or your fellow alumni to alumni@frib.msu.edu. Tell us about discoveries, business ventures, partnerships, awards, and other professional developments, and we may feature them in a future issue. Also let us know if there are other types of laboratory updates you'd like to see in future alumni issues.

Contributors this issue

- Thomas Glasmacher
- John Hollenbeck
- Colin Morton
- Artemis Spyrou
- Lindsey Spitzley
- Katie (Miller) Yurkewicz

LOOKING AHEAD

9-11 October	Experimental Systems Advisory Committee Review
7-9 November	Accelerator Systems Advisory Committee Review
5-7 December	DOE-SC Office of Project Assessment Review

The FRIB Laboratory Update for Alumni is published by the FRIB Laboratory and distributed via email. Please e-mail questions, comments, address changes, story tips, contributions, or requests to unsubscribe from this list to alumni@frib.msu.edu. If you are in touch with other NSCL/FRIB alumni, please forward this to them and invite them to contact us to subscribe.Register as an alumnus or update your contact info on the Alumni Directory Form.

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Michigan State University is establishing FRIB as a national user facility for the Office of Nuclear Physics in the U.S. Department of Energy Office of Science. Operation of NSCL as a national user facility is supported by the Physics Division of the U.S. National Science Foundation.