LABORATORY UPDATE for ALUMNI

NSCL FRIB

Summer 2021

We hope you are doing well as we move through 2021. At FRIB, we remain focused on the start of user operation in early 2022.

The FRIB Project is on track to deliver the baseline early, in late 2021. While we move ever closer to starting science, we are cognizant that the last mile is as critical as the first 25 in this marathon project. The FRIB staff is committed to completing the project and starting user operation, while also operating the standalone NSCL science program.

This summer, we send you this newsletter to highlight some of the biggest developments of 2021 so far. We commissioned the entire linac, including all 46 cryomodules, and we accelerated first beam in ReA6. This ushered in the first scientific-user experiment in ReA6 and the first stand-alone experiments using SOLARIS in AT-TPC mode. FRIB also successfully commissioned the liquid lithium charge stripper installed in the linac. FRIB is the first operating accelerator facility to use liquid lithium to charge-strip heavy-ion beams.

In a major development toward commencing science at FRIB, the FRIB Program Advisory Committee (PAC) has peer-reviewed the first set of science proposals for experiments that will be conducted after FRIB commences user operation in early 2022. The PAC-recommended experiments comprise exciting new research that was not possible prior to the completion of FRIB.

We're also pleased to share the good news about several laboratory and user committee award winners for various awards.

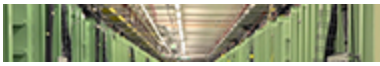
In the COVID context and in alignment with MIOSHA, FRIB has resumed its on-site functions. We look forward to a very big 2022, in which we will commence user operation of FRIB as a DOE-SC user facility.

We invite you to stay in touch and add/update your listing in the laboratory alumni database (see story below). The goal is twofold: to enable FRIB alumni to actively network with each other, and to show the world our trained workforce goes on to do great things! To that end, let us know what you're up to and what kind of content you would like to see in this newsletter. We want it to be useful to you.

Sincerely,

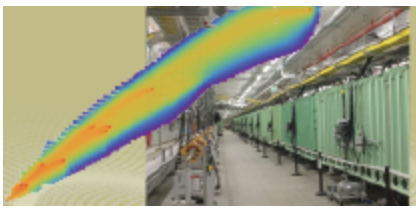
Thomas Glasmacher and Brad Sherrill
FRIB Laboratory Director and NSCL Director

MAJOR DEVELOPMENTS



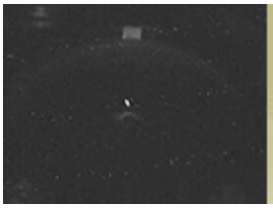
FRIB COMMISSIONS ENTIRE LINAC, INCLUDING ALL 46 CRYOMODULES

Ending April on a major high note, FRIB commissioned the entire linac, including all 46 cryomodules, on 25 April. The team commissioned a krypton-86 beam to 212 MeV/u, achieving 100-percent beam transmission in less than three hours on the first attempt. The team was distributed to five separate control rooms to comply with COVID-19 workplace safeguards. **Read more**



FRIB ANNOUNCES FIRST EXPERIMENTS

The first FRIB Program Advisory Committee (PAC) has peer-reviewed the first set of science proposals for experiments that will be conducted after FRIB commences user operation in early 2022. The PAC-recommended experiments align with national science priorities and span the four FRIB science areas: properties of rare isotopes; nuclear astrophysics; fundamental interactions; and applications for society, including in homeland security. **Read more**



NSCL ACCELERATES FIRST BEAM IN REA6, USHERING IN FIRST EXPERIMENT OF STANDALONE PROGRAM

NSCL reached an important milestone on 16 April with first acceleration of beam in the ReAccelerator facility ReA6, the upgraded ReAccelerator facility at NSCL and FRIB. It provides broader opportunities for nuclear physics experiments with higher beam energies than the previous ReA3. This milestone ushered in the stand-alone ReA6 program on 12 May with the first user experiment. **Read more about first beam** and **read more about the first experiment**.

FRIB SCIENTIFIC USERS COMPLETE FIRST SOLARIS EXPERIMENT

A team of FRIB scientific users completed the first SOLenoid spectrometer Apparatus for ReactIon Studies (SOLARIS) solenoidal spectrometer system experiment in the Active-Target Time-Projection Chamber (AT-TPC) mode. Argonne National Laboratory developed SOLARIS, a dual-mode spectrometer for a broad range of reactions studies at FRIB using reaccelerated beams. **Read more**

FRIB LABORATORY NEWS

FRIB'S NUCLEAR SCIENCE RESEARCH SUPPORTING THE NATIONAL NUCLEAR SECURITY ADMINISTRATION ENTERS ELEVENTH YEAR: The FRIB Laboratory is entering the eleventh year of its nuclear science research in the Nuclear Science and Security Consortium (NSSC). Funded by the National Nuclear Security Administration, eleven universities comprise NSSC. **Read more**

CONGRATULATIONS TO OUR LAB COMMUNITY

Sylvester Agbemava joined the FRIB Laboratory as a P. Gregers Hansen Postdoctoral Fellow in October 2020. During his time at the laboratory, Agbemava has worked with the nuclear theorists at FRIB to share ideas and form collaborations with other scientists while studying the mechanism of nuclear fission and properties of superheavy nuclei. **Read more**

Charlie Hultquist, a research assistant at FRIB and NSCL, has earned a Barry M. Goldwater Scholarship. **Read more**

Zachary Constan, NSCL and FRIB outreach coordinator, and Daniel Puentes, doctoral student in physics at FRIB, have won awards from the National Science Foundation (NSF)-funded Center for Advancing Research Impact in Society (ARIS).
Read more

Dennis Mücher from the University of Guelph in Ontario, Canada, is the award recipient for the FRIB Visiting Scholar Program for Experimental Science 2021. Initiated in 2016, the goal of the program is to recognize outstanding junior researchers in FRIB-rated research fields and encourage them to establish a research program at FRIB. **Read more**

Five scientists who have performed or will perform research at FRIB have received prestigious 2021 U.S. Department of Energy Office of Science (DOE-SC) Early Career Research Program awards. Selection is based on peer review by outside scientific experts. **Read more**

Jonathon Howard, a graduate assistant at the FRIB Laboratory, was named the 2021 recipient of the Klaus and Jean Timmerhaus Graduate Scholarship, a prestigious award in cryogenic engineering fields. Howard is part of the MSU Cryogenic Initiative, FRIB's collaboration with the MSU College of Engineering to train students to be future cryogenic engineers and system innovators. **Read more**

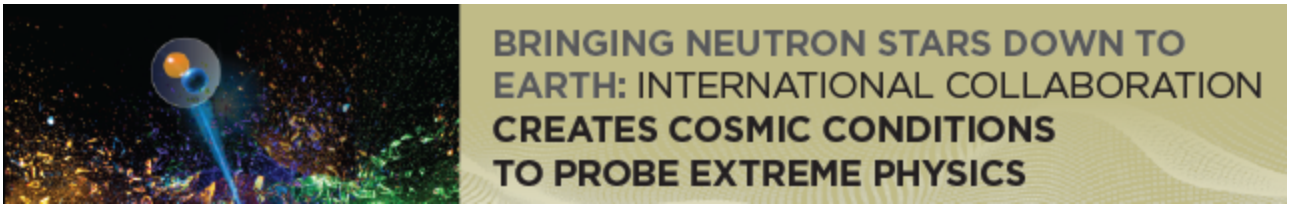
The FRIB Users Organization Executive Committee and the FRIB Theory Alliance Executive Board have announced the winners of the inaugural FRIB Achievement Award for Early Career Researchers. The award recognizes outstanding original contributions to the field of nuclear physics through work at or relating to FRIB, performed by scientists early in their careers. **Read more**

DO YOU HAVE ADDITIONAL GOOD NEWS? LET US KNOW! Email communications@frib.msu.edu

SCIENCE NEWS

In 2018, the U.S. Department of Energy Office of Science awarded Greg Severin and his team a grant to prove that isotope harvesting was feasible. The team did that by building a small-scale isotope harvester at NSCL. Now, with a new grant, the researchers are putting that plan into action at full scale. **Read more**

In a paper for Physical Review Letters, Witold Nazarewicz and Simin Wang show how FRIB can spot signatures of unusual nuclear events and use those as windows into the nucleus. **Read more**



An international collaboration, including Betty Tsang and William Lynch, has now emulated a neutron star's cosmic conditions on Earth to better probe that extreme science. The team shared its results in the journal Physical Review Letters. **Read more**

Scientists from the University of Surrey and the FRIB Laboratory at MSU teamed up to explore the origin of aluminum-26, a rare isotope that offers a window into dying stars. Their findings, "Exploiting Isospin Symmetry to Study the Role of Isomers in Stellar Environments," were published in Physical Review Letters. **Read more**

INSTRUMENT UPDATES

The FRIB community eagerly anticipates the impending completion of FRIB and building of the instrumentation necessary to realize FRIB's tremendous scientific potential.

CRIS: The Collinear Resonance Ionization Spectroscopy (CRIS) project will enhance the sensitivity of laser spectroscopy at FRIB by more than an order of magnitude. The design of the beam line extension of BECOLA for CRIS is complete, procurement of components has started, and assembly will be completed by mid-2022.

FDSi: The FRIB Decay Station initiator (FDSi) will be the first step towards full FDS and will increase discovery potential of FRIB. Phase one of FDSi (common infrastructure, new charged-particle implant detector XSiSi, and first set of new electronics) will be complete by start of FRIB user operation.

GRETA: The Gamma-Ray Energy Tracking Array (GRETA) is the realization of a full 4π γ-ray tracking detector, capable of reconstructing the energy and three-dimensional position of γ-ray interactions within a compact sphere of high-purity germanium crystals. The Gamma-Ray Energy Tracking In-beam Nuclear Array (GRETINA) demonstrated the technology and scientific impact of a γ-ray tracking array.

HRS: The High Rigidity Spectrometer (HRS) project accommodates different detectors, of which GRETA is one. The preliminary design has been advanced.

SECAR: The SEparator for CApture Reactions (SECAR) recoil separator project finished in 2020 and will be optimized for measurements of capture reactions of importance for nuclear astrophysics. Installation is complete, and commissioning will be completed in 2021. The second Wien filter has been commissioned, and the partial angular acceptance measurement is complete.

SOLARIS: The SOLenoid spectrometer Apparatus for ReactIon Studies (SOLARIS) solenoidal spectrometer system is on track for completion. The magnet is installed and energized, and fabrication of vacuum enclosure and beam line connection is complete.

ALUMNI SPOTLIGHT

ALUMNI SPOTLIGHT: KALEE FENKER: Kalee (Hammerton) Fenker earned a PhD in nuclear chemistry at Michigan State University and was at NSCL from 2013 to 2017. She is currently a staff scientist in the nuclear measurements group at Savannah River National Laboratory. **Read more**

TRAINING THE NEXT GENERATION

HIGH-SCHOOL STUDENT EYES SCIENCE FUTURE AT FRIB: Maya Wallach is a high-school student who follows MSU's physics curriculum and takes courses at MSU. She is gaining first-hand experience at the FRIB Laboratory as she pursues a science career. Her time at FRIB is part of the Physicists Inspiring the Next Generation: Exploring the Nuclear Matter program. **Read more**

ACCELERATOR TRAINEESHIP ADVISORY PANEL (ATAP) MEETING (2-3 June): ATAP held a meeting via remote participation on 2-3 June 2021. The focus was to review the Accelerator Science and Engineering Traineeship (ASET) program at MSU and to provide recommendations to the FRIB Laboratory director. ASET is supported by the U.S. Department of Energy Office of Science (Office of High Energy Physics), and a DOE-SC representative participated in the meeting. The panel found that the ASET program is functioning well and the students' high-quality research work assures that ASET is addressing the goal of meeting the workforce need under the program. **Read more**

HIGH-SCHOOL STUDENT PART OF FRIB-AFFILIATED RESEARCH GROUP WITH PUBLISHED RESEARCH PAPER: The FRIB-affiliated Lee Research Group authored a research paper ("Rodeo Algorithm for Quantum Computing") that was recently published in Physical Review Letters. The members of the group who carried out the research are Zhengrong Qian, an MSU undergraduate student, Joey Bonitati and Jacob Watkins, PhD students at MSU, and Kenneth Choi, a recent graduate of Ridgefield High School in Ridgefield, Connecticut, who will be attending the Massachusetts Institute of Technology. **Read more**

IN THE NEWS

FRIB and FRIB scientists have been featured in a number of articles at several different news outlets, including:

WHY ARE THEORISTS EXCITED ABOUT EXOTIC NUCLEI? (Physics Today): FRIB's Filomena Nunes discusses how the limits of nuclear stability provide deep insights into the fundamental force responsible for the presence of matter. **Read more**

BIGGEST EXPANSION OF KNOWN CHEMICAL UNIVERSE TARGETED BY FRIB NUCLEAR FACILITY (Physics World): (Originally published as "The beams at the edge of physics" in the February 2021 issue of Physics World) The upcoming Facility for Rare Isotope Beams in Michigan is a cutting-edge accelerator that promises great things for nuclear physicists, especially those with applications in mind. **Read more**

MSU'S FRIB IS 95-PERCENT DONE; HUNDREDS OF SCIENTISTS APPLY TO DO RESEARCH HERE STARTING IN EARLY 2022 (Lansing State Journal): MSU's $730 million Facility for Rare Isotope Beams is about 95-percent complete, said FRIB Laboratory Director Thomas Glasmacher. And scientists

are already asking to use the FRIB's 400-kilowatt superconducting linear accelerator. A subscription to the Lansing State Journal is required to view this article. **Read more**

STABLE NICKEL-64 NUCLEI TAKE THREE DISTINCT SHAPES (Newswise): Scientists have identified three distinct shapes in stable nickel-64, a stable isotope of nickel. This discovery increases the predictive power of such nuclear structure calculations for nuclei that can only be reached at next-generation rare-isotope facilities such as the Facility for Rare Isotope Beams. **Read more**

UPDATE YOUR INFORMATION IN FRIB ALUMNI DIRECTORY

The FRIB Laboratory has an alumni directory form to communicate with laboratory alumni and to track their career paths. Please take a couple of minutes to fill out or update the form by answering a few simple questions. This will ensure our records are accurate and build a more reliable network we hope you find useful. Visit the online alumni directory form to enter and update information.

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.

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Michigan State University establishes and operates FRIB as a user facility for the Office of Nuclear Physics in the U.S. Department of Energy Office of Science.