50 YEARS OF BEAM
MICHIGAN STATE UNIVERSITY
NSCL FRIB

1965-2015

Celebrating 50 years of beam at Michigan State University on October 8, 2015.

As we transition from the National Superconducting Cyclotron Laboratory and the Facility for Rare Isotope Beams Project into the FRIB Laboratory, we invite you to join current FRIB Laboratory staff at a special program to honor our past and look to our future.

MSU's legendary President John A. Hannah seized upon the idea that developing a program in nuclear physics would be a cornerstone of his strategy for growth and diversification of the university. In 1958, he invited Henry Blosser to come to MSU to build a cyclotron. Blosser—an ambitious visionary with determination, leadership skills, and theoretical and technical expertise—assembled a remarkable team, and together they succeeded in designing, building, and funding MSU's first cyclotron, the K50, completed in 1965 and used for nuclear research with proton beams.

Fifty years since the first beam from the K50 cyclotron, we are poised for the next generation of nuclear physics at MSU, as we build the Facility for Rare Isotope Beams, scheduled for completion in 2022.

Former NSCL Director Konrad Gelbke was a pivotal part of bringing FRIB to MSU, and we will honor his remarkable career on October 8 with a scientific symposium. Konrad stepped down in May 2015 after 23 years as director of NSCL. The speakers and session chairs at the symposium are Konrad Gelbke's former graduate students and postdocs who moved on to diverse careers in academia, national laboratories, and industry. In addition, Konrad's broader impact on nuclear physics will be highlighted by representatives from NSF and DOE.

The events will take place in the Pasant Theatre at the Wharton Center for Performing Arts, on MSU's campus. The full program is:

8 to 9 a.m.	Registration, light refreshments
9 to 11 a.m.	Speakers, book presentation, and original music compositions Program will include: ◆ stories and anecdotes from former and current employees ◆ a presentation of and selected readings from Laboratory Director Emeritus and author Sam Austin's new book "Up from Nothing" (for sale now via the MSU Press), which tells the story of the cyclotron and chronicles the history of the National Superconducting Cyclotron Laboratory ◆ original compositions by MSU College of Music faculty member Mark Sullivan – (*Isotope Table*, *Three Isotopes*, *Neutron Star 01*), and alumni composers Benjamin Fuhrman (*Separation Anxiety*, *Mind the Gaps*) and Matthew Schoendorff (*The Atomic Wait*, *Kaleisotope*)
11 to 11:30 a.m.	Break
11:30 a.m. to 12 p.m.	Remarks
12 p.m.	Hosted lunch outside Wharton Center
12 to 2 p.m.	Tours of NSCL and the FRIB construction site
2 to 5:30 p.m.	Scientific symposium honoring former NSCL Director Konrad Gelbke. ◆ Symposium speakers and session chairs have been selected from Konrad's former graduate students and postdocs who since have moved on to diverse careers in academia, national laboratories, and industry. In addition, representatives from NSF and DOE will highlight Konrad's broader impact on nuclear physics.

Facility for Rare Isotope Beams | Michigan State University | 640 South Shaw Lane | East Lansing, MI 48824 | (517) 355-9672
frib.msu.edu | nscl.msu.edu | events@frib.msu.edu

Michigan State University is establishing FRIB as a scientific 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 Experimental Nuclear Physics Program of the U.S. National Science Foundation

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Electronic Miniatures

original compositions by

Dr. Matthew Schoendorff

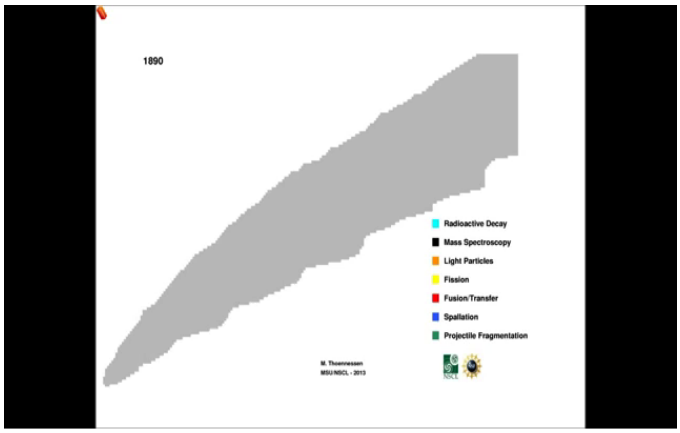
Composer • Arranger • Music Educator
www.matthewschoendorff.com

Keith Thompson, Recording Engineer
Yeah Haus Design Studio; Ferndale, MI
http://yeahhaus.com/

INTRODUCTORY PROGRAM NOTES:

THE ATOMIC WAIT

The discovery of rare isotopes dates back at least to the turn of the 20th century. Such early methods involving measurements of radioactive decay often were crude and unsafe. Gradually, as the century progressed, methods of rare isotope discovery improved, both in terms of safety and greater yields of data collected and catalogued. Methods involving mass spectroscopy, light particles, fission, fusion/transfer, and spallation proved to be increasingly more effective. However, it was not until the development of the exceedingly successful method of projectile fragmentation that the discovery rate of rare isotopes hit an unprecedented stride. Michigan State University has been instrumental in the institution and development of particle acceleration/projectile fragmentation isotope beam technology, beginning with the construction and implementation of the K50 in 1965. Since then, the MSU Cyclotron Laboratory has partnered with the National Science Foundation (NSF) to further establish the Heavy Ion Laboratory in 1977 and the National Superconducting Cyclotron Laboratory (NSCL) in 1980. Now, fifty years after the first beam K50 cyclotron, the NSCL at MSU prepares for the next phase in the future generation of nuclear physics research with the construction of the Facility for Rare Isotope Beams (FRIB), projected to be fully operational by 2022.



The progression of isotope discovery methods is detailed below in a short animation that reveals how and when different isotopes were discovered throughout the world, made possible by recent research and papers from NSCL Associate Director Michael Thoennessen. As a complement to this simulation (in concept, not timing), *The Atomic Wait* employs equal-tempered equivalents of the pitches found in a given harmonic series the equal-tempered acoustic scale as a substitute for. Successive methods of isotope discovery are represented as each new overtone pitch is introduced at decreasing temporal intervals. A tipping point is finally reached, corresponding with the inaugural use of projectile fragmentation at MSU's NSCL. At this point, the sonic build through the equal-tempered harmonic series gives way to uncontrolled electronic noise as more and more rare isotopes continue to be discovered. The title is a play on the term *atomic weight*, nomenclature borrowed from isotope distribution. The homophone substitution of *wait* for *weight* is in reference to the slow, gradual rate of isotope discovery until the introduction of rare isotope beam technology finally explodes the rate of isotope discovery.

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KALEISOTOPE

While *The Atomic Wait* emphasizes the impact of the beam on isotope discovery rates, *Kaleisotope* depicts a simplified and generalized version of how rare isotopes are discovered with collider technology in a particle accelerator. The blatant merging of the terms 'kaleidoscope' and 'isotope' in the title implies a visual analogy between the colorful variation and repetition of objects when viewed through a kaleidoscope, and an isotope as a more "colorful" variation of an atomic element. The harmonic series again provides the basic referenced musical materials, from which an equal-tempered acoustic scale is derived, often simulating a diatonic set. In *Kaleisotope*, two simple and repetitive musical themes are introduced in counterpoint with each other. These represent particles in a collider. They gradually phase out of sync, then back into sync as they collide. A related third theme of repetitive chords in progression then emerges, representing a rare isotope now observed post-collision. This isotope decays amid a musical transition of "noise," and the theme of the known isotope dissipates into variations of possibility that additional rare isotopes are yet to be found. The chords of the third theme are still present, yet somehow different now. (In this case, certain audio filters, arpeggiators, and effects were applied to the original chords.) Though not as readily recognizable post-transformation, varied hints of the original two themes "pre-collision" interact with the chords in variation, until even this material dissipates.

BIOGRAPHICAL INFORMATION

Matthew Schoendorff (B.M.—Music Education and Composition, Western Michigan University; M.M. and D.M.A.—Music Composition, Michigan State University) composes music for an eclectic range of ensembles, voice types, and media. His works have been performed on several continents and are listed on many state band and orchestra required music lists. Schoendorff maintains an active composing career and has provided arrangements for the *Opera Remix Initiative* at the Townsend Opera Company in Modesto, CA. He is the composer-in-residence for the NUCLASSICA ensemble, Theory & Composition Chair at the National Music Institute for Young Artists (currently in affiliation with the Cranbrook Educational Community in Bloomfield Hills, MI), and teaches music theory and composition at Wayne State University in Detroit, MI. Select titles are published by Grand Mesa Music Publishers, TRN Music Publisher, and others.

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