The **MoNA** Report

The MoNA Collaboration

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Preface

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Need new write-up from Warren ***Executive Director, the MoNA Collaboration***
Santa Barbara, CA, July 31, 2015

// —> COMMENTS

1 Introduction

The exploration of the limits of stability and the observation of new phenomena in nuclei far from stability has been identified as one of the key science drivers for a next generation U.S. facility for rare-isotopes [1]. The first step following the discovery of new isotopes is the study of fundamental properties, for example, masses, binding energies, and lifetimes.

At the very extreme of neutron-rich nuclei, the nuclei beyond the dripline are very short lived and can only be studied by reconstruction based on information gathered from their decay products. Also, nuclei close to the neutron dripline have no or only a few bound excited states, so that traditional γ-ray spectroscopy cannot be applied. However, these states can be explored by neutron–fragment coincidence measurements. Reactions on such exotic nuclei reveal dynamical nuclear properties such as new preferred modes of excitations. When such reactions involve neutrons they are often of interest for explosive astrophysical scenarios. The most efficient and economical way to produce and perform experiments on these nuclei is with rare isotopes produced by high-energy projectile fragmentation. In order to reconstruct the decay energy spectrum, a magnet to deflect the charged fragments and a highly efficient position sensitive neutron detector are necessary.

The Modular Neutron Array (MoNA) was constructed and is operated by a unique collaboration of primarily undergraduate physics departments in partnership with Michigan State University. It has already involved more than 100 undergraduates from over 25 colleges and universities in nuclear physics experiments. The MoNA collaboration is poised to play an important role in educating the next generation of nuclear physicists. This paper outlines the importance of the physics which MoNA can do at a fast fragmentation facility and the potential role of the collaboration in educating future nuclear physicists.

The publications and presentations that detail the results obtained by the collaboration can be found in Section 6. Also cataloged are the students that have benefitted from work with the device in Section 7. A summary of the systems studied is shown in Figure 1.

2 Physics with MoNA

2.1 Results and perspectives

Nuclear structure and reactions at and beyond the dripline

Along the neutron dripline where the neutron binding energy becomes zero, the relatively small enhancement of the total binding energy for paired neutrons has an important effect. The stability of nuclei with even numbers of neutrons N compared to their neighbors with odd numbers creates a saw-tooth pattern in which the heaviest odd-N isotopes of a given element are neutron-unbound, while heavier isotopes with an even number of neutrons can be bound. Well-known examples are ^{10}Li (unbound) and ^{11}Li (bound), or ^{21}C (unbound) and ^{22}C (bound). The properties of the alternating neutron-unbound nuclei provide important insights into the neutron–nucleus interaction far from stability, the coupling to the continuum in neutron-rich systems, and the delicate structure of multi-neutron halos or skins. In addition, the wave functions of the even-N nuclei at the dripline are not well known, and studies of the adjacent neutron-unbound (odd-N) nuclei can yield single-particle information crucial for the characterization of the heavier bound nuclei.

*Properties of neutron-unbound nuclei **Need references??**

// —> COMMENTS Intense fragment beams of the most exotic bound nuclei have been used at the National Superconducting Cyclotron Laboratory (NSCL) and elsewhere to extend mass determinations from reaction Q-value measurements to neutron-rich nuclei beyond the dripline, where the ground state is an unbound resonance. In a typical experiment, the energies and angles of the neutron and the fragment from the decay of the unbound parent nucleus must be detected with sufficient precision to allow reconstruction of the energies of the resonant states. The observed decay energy determines the mass while the width of the resonance is related to the angular momentum of the state. Just as for traditional transfer reactions, different reaction channels provide complementary information, and both proton and neutron removal reactions are important and necessary to populate the neutron-unbound states. Nuclear masses and angular momenta of ground-state wave functions of unbound nuclei provide information on the shell structure at the neutron dripline that cannot be obtained by other means.

Neutron-unbound excited states

Neutron-unbound excited states of bound nuclei can be populated either in nuclear breakup reactions via excitations from the ground state or via particle removal reactions from neighboring nuclei.

Breakup reactions where the nucleus is excited via the nuclear or Coulomb interaction are versatile tools to study continuum properties. For example, Coulomb-breakup of halo nuclei is mostly sensitive to the s-wave component of the ground-state wave function and hence will be able to provide a spectroscopic factor for a core $\otimes$ $s_{1/2}$ configuration in the ground state of the nucleus of interest [2]. Such measurements could be precision tests of results from the more common knockout or transfer reactions, since the reaction mechanism of Coulomb breakup is better understood theoretically.

Several interesting quantities are accessible by particle removal reactions. For one, the energy and decay path of resonances are of interest for nuclear structure. Also, high-lying first excited states are indicative of gaps in the single-particle level scheme and suggest new magic

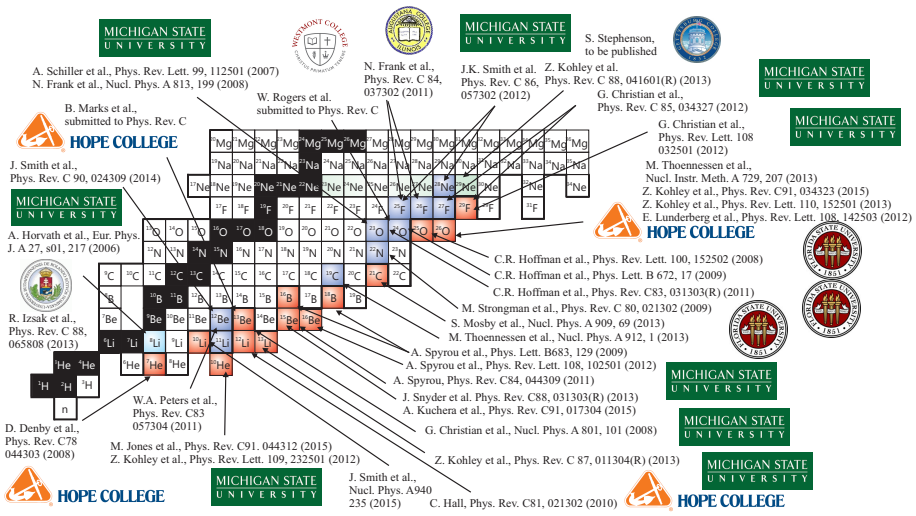

Figure 1: A portion of the chart of the nuclides showing collaboration measurements.

numbers. The energy of resonances can shed light on the role of the continuum in nuclear structure at the dripline. Moreover, particle-removal cross sections to resonances yield spectroscopic factors, which can again be compared with theory.

Neutron halos

Weakly bound few-body systems have been found to exhibit properties such as halo structures, which are very different from those of well-bound systems. The study of these neutron halos is important for a better understanding of nuclear structure close to the dripline and also helps to understand the universal features of weakly bound few-body systems in general. For example, halo structures are also found in atomic and molecular systems [3, 4]. Close to the neutron dripline, a number of nuclei have been found to exhibit neutron halos [5], and many more are predicted to exist [4].

When the last neutrons in a nucleus are weakly bound and have predominant *s*-wave character, the absence of a confining Coulomb and angular-momentum barrier allows the extension of the neutron wave function far beyond the nuclear core via quantum-mechanical tunneling. The attraction of the nuclear potential is weak in this extended region and, as a result, the nucleus develops a diffuse halo with one or a few neutrons distributed over a large volume. The radial wave function of such a halo depends critically on the neutron separation energy. Thus, precise measurements of nuclear masses and separation energies of these exotic systems provide important information for theoretical descriptions as well as for the identification of new halo candidates.

2.2 Invariant mass measurements

The study of neutron-unbound systems using the Sweeper and MoNA-LISA devices are based on the well-established technique of invariant mass measurements. Determining the population of unbound states in nuclear reactions through knock-out, breakup, or transfer reactions, followed by detection of all of the decay products in coincidence, *i. e.* the neutron (or neutrons, indexed n) and the charged fragment (indexed f), is necessary. Measurement of the energies (E_n and E_f) and momentum vectors ($\vec{p}_\mathrm{n}$ and $\vec{p}_\mathrm{f}$) of the involved particles enables the reconstruction of the invariant mass or the decay energy (see Figure 2). The decay energy E_d is the invariant mass of the unbound system minus the sum of the separate particles' masses and for one-neutron decay is given by:

$$E_\mathrm{d} = \sqrt{m_\mathrm{f}^2 + m_\mathrm{n}^2 + 2(E_\mathrm{f}E_\mathrm{n} - \vec{p}_\mathrm{f}\cdot\vec{p}_\mathrm{n})} - (m_\mathrm{f} + m_\mathrm{n})$$

These invariant mass measurements are performed with a large-gap dipole magnet or "Sweeper" that separates the unreacted beam, charged reaction products, and neutrons in such a way that the forward-going undeflected neutrons are cleanly detected in a high-efficiency neutron detector such as MoNA-LISA (see Figure 2).

2.3 Technical overview

Modular Neutron Array

The Modular Neutron Array (MoNA) is a large-area, high efficiency neutron detector designed for neutrons resulting from breakup reactions of fast fragmentation beams.

In its standard configuration, MoNA has an active area of 2.0 m wide by 1.6 m tall (see Figures 3 and 6). It measures both the position and time of neutron events with multiple-hit capability. The energy of a neutron is based on a time-of-flight measurement. This information together with the detected position of the neutron is used to construct the momentum vector of the neutrons [6, 7].

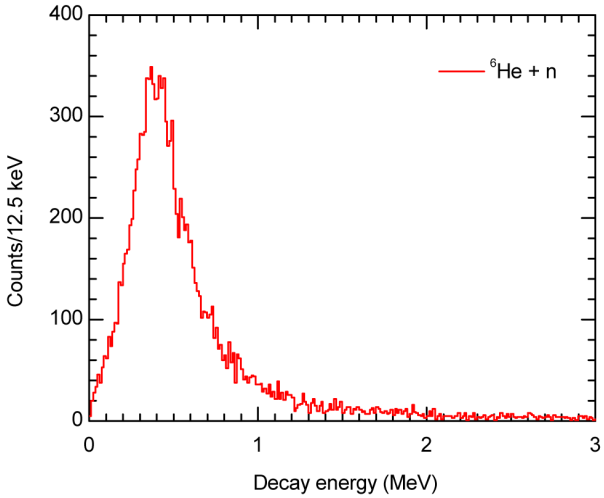

Figure 2: The reconstructed decay-energy spectrum for the neutron-unbound ground state in ^{7}He, which is unbound by 450 keV and which has a width of 160 keV. The data were taken during the commissioning of the Sweeper Magnet and the MoNA neutron detector at NSCL.

Figure 3: The Modular Neutron Array and Large-area multi-Institutional Scintillator Array (MoNA-LISA).

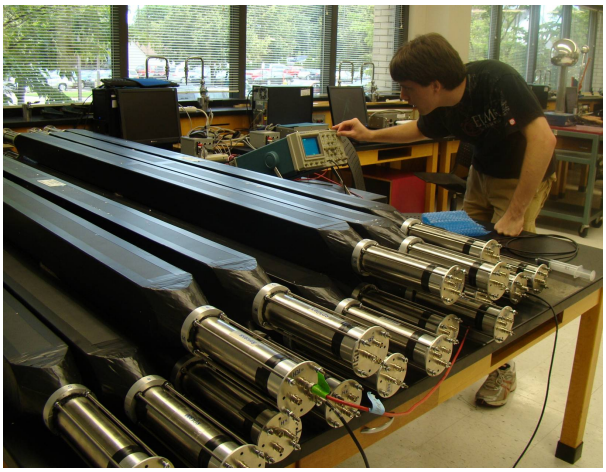

Figure 4: Assembled LISA modules being tested.

The detection efficiency of MoNA is maximized for the high-beam velocities that are available at the NSCL Coupled Cyclotron Facility (CCF). For neutrons ranging from 50 to 250 MeV in energy, it is designed to have an efficiency of up to 70% and expands the possible coincidence experiments with neutrons to measurements which were previously not feasible. The detector is used in combination with the Sweeper magnet [8–12] and its focal plane detectors for charged particles [13]. In addition, the modular nature of MoNA allows it to be transported between experimental vaults and thus to be used in combination with the Sweeper magnet installed at the S800 magnet spectrograph [14]. Due to its high-energy detection efficiency, this detector in conjunction with LISA (see next section) will be well suited for experiments with fast fragmentation beams at FRIB.

Large-area multi-Institution Scintillator Array (LISA)

A collaborative MRI proposal was submitted by nine PUI institutions in the collaboration (CMU, Concordia, Gettysburg, Hope, IUSB, OWU, Rhodes, Wabash, and Westmont) to enhance the neutron detection capabilities. LISA is a second large array (144 modules, see Figure 4) which can be configured for additional angle coverage or for additional efficiency. The increased neutron detection efficiency possible with the combined MoNA-LISA array means it will be an effective day-one FRIB detector system.

LISA was constructed by undergraduate students at the nine institutions (Figure 4). Construction was essentially completed during the summer of 2010. Each institution carried out testing and used their subset of detector modules for student education. The projects being undertaken by students at each institution range from muon-lifetime measurements, to cosmic-ray shower size measurements, to γ–γ correlation measurements using the full position reconstruction. The modules were moved to NSCL in January of 2011. After mechanical installation was completed, LISA was integrated with MoNA and the

Figure 5: Sweeper magnet

Sweeper and the commissioning experiment (neutron unbound states in ^{24}O) took place in June of 2011.

Sweeper magnet

The Sweeper magnet is a large-gap dipole magnet that was developed and built at the National High Magnetic Field Laboratory at Florida State University [8–12]. It was funded by the NSF with a Major Research Instrumentation (MRI) grant to a MSU/FSU consortium. The superconducting magnet is able to deflect charged particles up to a rigidity of 4 Tm in order to separate neutrons, charged reaction products, and the non-reacting beam particles. The vertical gap between the pole tips measures 14 cm and a large neutron window enables the neutrons coming from the reaction target placed in front of the Sweeper to reach MoNA and LISA, typically placed at 0° with respect to the incoming beam direction.

Sweeper focal plane box

The Sweeper focal plane box, which is placed at a 43° angle behind the Sweeper magnet, contains the charged particle detectors [13]. A set of position-sensitive cathode readout drift chambers (CRDC) provides position and angle of the charged reaction products. An ionization chamber is used for the energy-loss information and a timing scintillator for the flight-time determination. A segmented CsI hodoscope stops the charged particles at the end of the focal plane box and measures their total kinetic energy. All of these quantities are used to identify the reaction products and to determine their properties such as velocity and direction of movement.

CsI Hodoscope

The CsI Hodoscope was assembled, tested and installed in 2012 by Dr. Nathan Frank and students at Augustana College in Rock Island, IL. The new hodoscope array consists of twenty five sodium-doped CsI crystals (3.25" x 3.25" x 2") arranged in a 5 x 5 configuration (see 8). The array measures the kinetic energy of charged fragments with a resolution of approximately 1% for GeV energies. The improved resolution makes experiments utilizing reaction mechanisms such as (d,p) possible.

Segmented Active Target

A segmented target will be available in 2015 for experiments. The target consists of alternating layers of Silicon detectors (62 mm x 62 mm x 140 μ) and Be typical 470 mg/cm^2, 2,500 μ) targets. The energy loss of secondary beam or charged reaction product nuclei are measured in each detector. The energy loss information is used to determine in which target the nuclear reactions take place. This determination will provide a means to keep the resolution in decay energy measurements constant while increasing statistics by making a thicker target.

Liquid Hydrogen Target

The Liquid Hydrogen Target at the NSCL offers a high-density, low-background proton or deuteron target for elastic scattering, nucleon transfer reactions, secondary fragmentation, and charge exchange experiments. The target (see 9) works by pumping deuterium gas into a cylindrical chamber sealed with $\sim$100 μm thick kapton foils on either side. The target chamber has a diameter of 5cm and can provide several target thicknesses depending on the depth of the chamber and density of the gas. Thicknesses of 200 or 400 mg/cm^2 are currently available for deuterium. Liquid helium is then used to cryogenically cool the gas close to the triple point, and a heating block warms the deuterium to approximately 1.5K below the boiling point to keep it in a liquid state. The system can hold 160L of deuterium at 1 atm. It was used at NSCL for the ^{24}O(d,p) experiment (e12004) whose goal was to measured negative parity states in neutron-unbound ^{25}O.

Experimental Layouts

The complete experimental setup of MoNA-LISA and the Sweeper magnet is located in a dedicated vault (see Figure 10), in which it is possible to place MoNA and LISA at angles different from 0° with respect to the incoming beam axis. This allows configurations with larger angular coverage, or a measurement of neutrons at large lab angles.

Event-tagged readout

For MoNA-LISA-Sweeper experiments the data from the various detector subsystems are read out in an event-

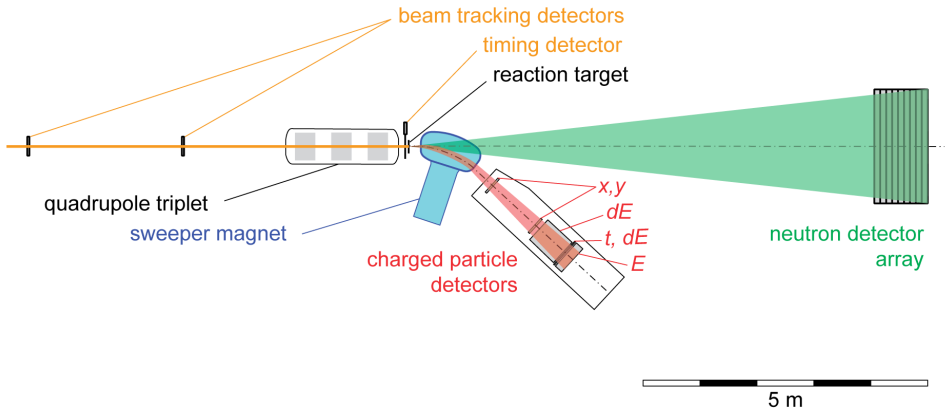

Figure 6: Schematic layout of the Sweeper–MoNA setup.

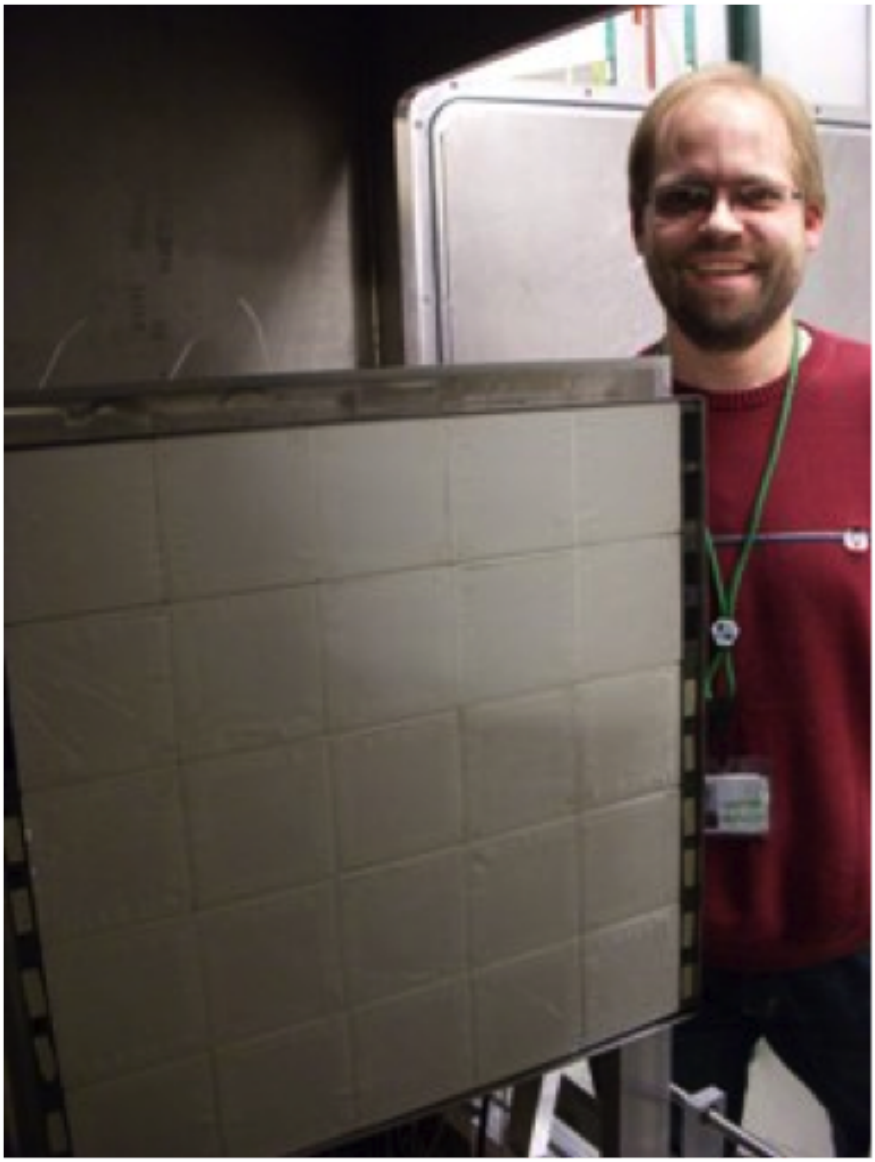

Figure 7: The CsI hodoscope with Nathan Frank.

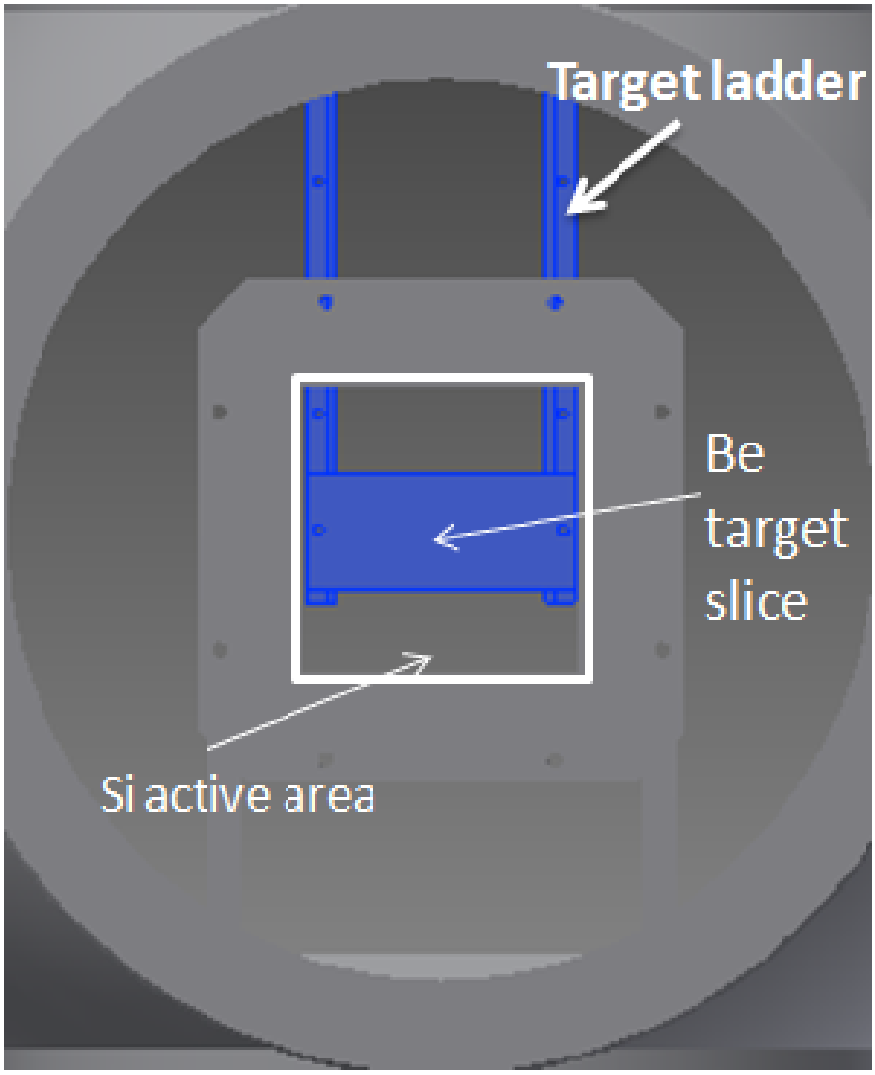

Figure 8: Beam eye-view of the proposed Si-Be segmented target to be used at NSCL.

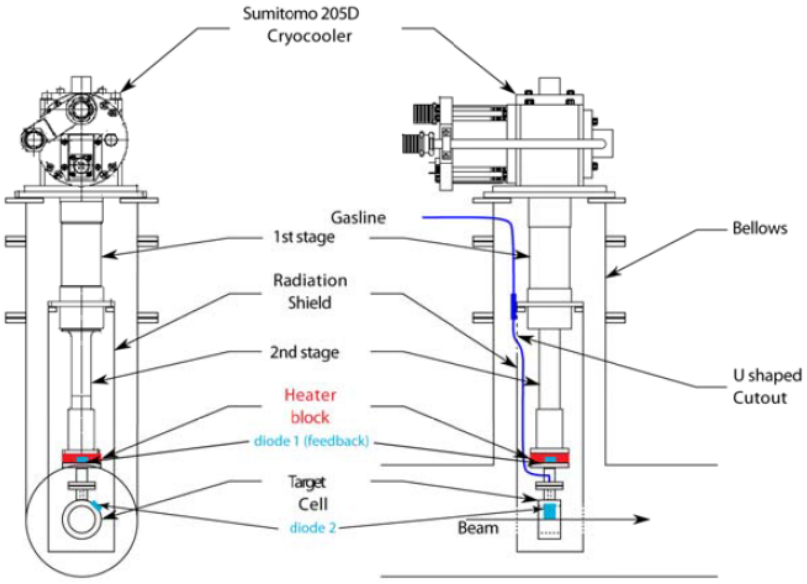

Figure 9: A diagram of the Liquid Deuterium Target illustrating how it will sit in the beam-pipe.

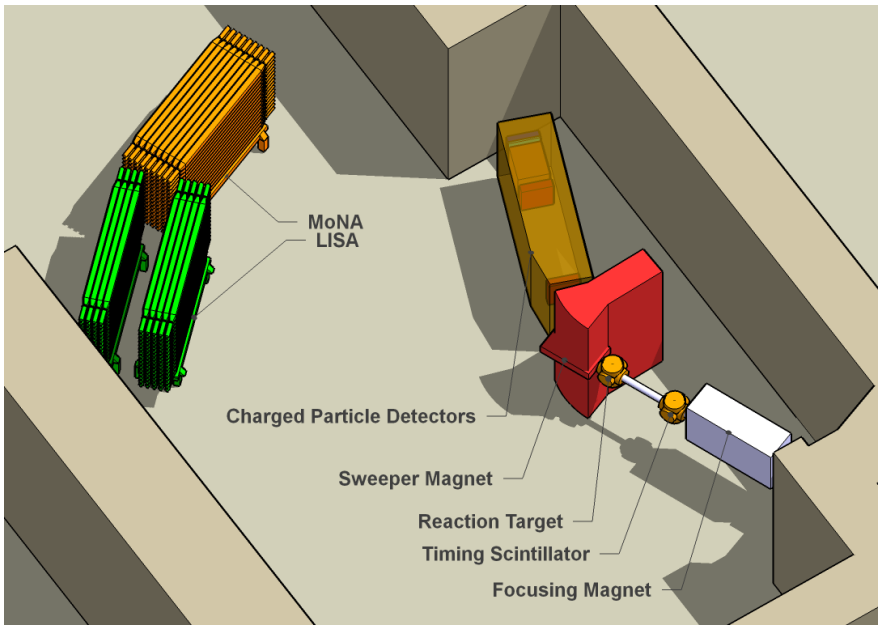

Figure 10: Recent layout of MoNA-LISA in the N2 vault.

tagged scheme. Each detector subsystem runs its own readout and records its data separately. By using separate data acquisition computers, the system becomes easily expandable, e. g. if an additional detector subsystem like a γ-ray detector needs to be added, while the overall readout time is reduced compared to a system with a large number of VME bins. A common system-wide trigger is generated by the trigger logic. A clock signal is fed into scalers that create an event tag for each time the subsystems are read out. This event tag is used off line to match and re-assemble event data from the subsystems.

2.4 Auxiliary uses of MoNA-LISA

In addition to the primary fragmentation physics, there are some off-line uses for MoNA. These include measurements of the temporal and spatial dependence of the cosmic-ray flux. These efforts provide additional student training with acquisition, detectors, and analysis.

3 The MoNA collaboration

3.1 History

When the NSCL upgraded their capabilities to the Coupled Cyclotron Facility, an FSU/MSU consortium built the Sweeper magnet to be used with two existing neutron walls to perform neutron–fragment coincidence experiments. The neutron walls were originally built for lower beam energies and had only a neutron detection efficiency of about 12% for the energies expected from the CCF. During the 2000 NSCL users meeting a working group realized the opportunity to significantly enhance the efficiency with an array of more layers using plastic scintillator detectors.

Several NSCL users from undergraduate schools were present at the working group meeting and they suggested that the modular nature and simple construction would offer great opportunities to involve undergraduate students.

In the spring of 2001 the idea evolved into several MRI proposals submitted by 10 different institutions, most of them undergraduate schools. The proposals were funded by the NSF in the summer of 2001. Following the detailed design, the first modules of the detector array were delivered in the summer of 2002. During the following year all modules were assembled and tested by undergraduate students at their schools [16], and finally added to form the complete array at the NSCL (Figure 11).

The MoNA collaboration continued after the initial phase of construction and commissioning was concluded [17], and is now using the detector array for experiments, giving a large number of undergraduate students from all collaborating schools the opportunity to take part in cutting-edge nuclear physics experiments at one of the world's leading rare-isotope facilities. The research at the undergraduate institutions is funded by the NSF through several RUI grants (Research at Undergraduate Institutions).

In 2012, Hampton University (which is a Historically Black College), Michigan State University and Augustana College received an award from the National Science and Security Consortium [18], a DoE/NSA funded consortium, to join the MONA collaboration. The HU/MSU/Augustana proposal focused on the construction of the segmented target. Since its involvement, several students from three minority institutions have been included in MONA related research: two graduate students (both from Hampton University) and three under-

Issues and Events

Undergraduates Assemble Neutron Detector

Spreading the construction of a detector across several institutions brings project visibility to participants.

"The undergraduates come running." So says Ruth Howes about student participation in the Modular Neutron Array, or MoNA, a detector built in large part by undergraduate physics majors. Howes, chair of the physics department at Marquette University in Milwaukee, Wisconsin, says it is unusual and significant that students can work on MoNA without leaving their home institutions. The detector was installed last summer at the National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University in East Lansing.

With MoNA, says MSU's Michael Thoennessen, the project's leader, "we can address one of the most interesting questions in heavy ion physics: For a given proton number, what's the heaviest isotope you can make?" For oxygen, this limit—called the dripline for isotopes that persist for milliseconds—is ^{24}O; with one more neutron, ^{25}O lives only 10^{-9} seconds. An experiment planned for MoNA, Thoennessen adds, "is to take a beam of fluorine-26, which we can make here at the lab, and send it to a thin target, typically beryllium, to strip a proton. Then ^{26}F becomes ^{25}O, which decays immediately into ^{24}O." From the ejected neutron's time-of-flight and position on the detector, "we can get the neutron's energy and can reconstruct to show that ^{25}O was created, how long it lived, and what its decay energy was," says Thoennessen.

The facilities offering the biggest competition for MoNA, he adds, are GSI in Darmstadt, Germany, RIKEN in Tokyo, and GANIL in France.

Ranking right up with the project's scientific potential is student involvement, which helped drum up funding. Recalls Jim Brown, a physicist at Wabash College in Crawfordsville, Indiana, "At a users' meeting, I popped off with, 'Nothing looks too difficult to assemble. We could get undergraduates.' My idea was that it would involve my students—it would give my guys something to do that would be good. Michael Thoennessen called a couple of months later, and said yes." NSF funded the project with more than $900 000, split among the 10 campuses that built MoNA.

Nontraditional students

The detector consists of 144 two-meter-long plastic scintillator bars arranged in 9 vertical layers of 16. Photons created when incident neutrons interact with the scintillator are recorded by photomultipliers at the ends of the bars. MoNA is sensitive to neutron energies from 50 to 250 MeV.

Perhaps the most novel aspect of the construction process was that students could work on MoNA from their home institutions. To be sure, some did go to NSCL through NSF's Research Experience for Undergraduates program. But others signed on directly through their physics departments. "Increasingly, undergraduate physics departments are seeing nontraditional students," says Howes. "One of my undergraduates had been a funeral director. He was 30 and had a steady girlfriend. Another had worked in industry and had a wife. They appreciate being involved in real, publishable research, but they can't leave home the way 20-year-olds can, for the whole summer."

A local presence on college campuses brings other benefits, Howes says. "Pieces of hardware were delivered to undergraduate institutions. That meant we had labs with equipment. This is far more interesting to a casual passerby than a work station." As a result, she adds, it is easier to attract students and to obtain the internal grants and fellowships that "you depend on when you are at a small college." MoNA members, in addition to MSU, Marquette, and Wabash, are Central Michigan University in Mt. Pleasant; Concordia College in Moorhead, Minnesota; Florida State University in Tallahassee; Hope College in Holland, Michigan; Indiana University at South Bend; Western Michigan University in Kalamazoo; and Westmont College in Santa Barbara, California.

Phil Voss, who began working on MoNA as a junior at Central Michigan University, describes a stint at MSU: "We had two hours of lectures every morning. We calibrated [the detector], did some dirty work, painted a couple

The Modular Neutron Array (left) was assembled by undergraduates (above) at Concordia College and nine other institutions.

Figure 11: Physics Today article about MoNA [15]

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Figure 12: Undergraduate students are being trained in the assembly and testing of MoNA detector modules.

graduate students (from Hampton University, Howard University and Alabama A&M University). Dr. Paul Gueye, PI of the Hampton University grant, officially joined the MONA Collaboration in 2013.

3.2 The role of undergraduate students

The physical characteristics and performance of MoNA were not the only things carefully considered by the collaboration. From the outset, several goals for the education of undergraduate students were identified: How can these students be continually and effectively involved in forefront research? What are the benefits to the students from this participation? What are the benefits to institutions and faculty members? When students participate in the experiments and when they work with the data sets, how can they evolve from passive watchers to active doers with the responsibility to get answers?

The collaboration has addressed this challenge by creating intensive summer sessions designed for undergraduates, encouraging students to participate in all phases of experiments, holding several meetings a year that include undergraduate participants, and employing information technology to bring the distant undergraduate students together (Figure 12).

Many voices have recognized the need for a strong basic science program in the United States. Most recently the National Academy of Sciences published the "Rising Above the Gathering Storm" study that outlines consequences and needed actions. The coming decade will need a steady stream of people (new physicists) as well as strong financial support. As in the past many of these people will come from undergraduate institutions and the most prepared will be those involved in meaningful undergraduate research as done by the MoNA collaboration at the NSCL involving fragmentation. While planning future installations for nuclear physics, the value of this educational approach and training must be recognized. Undergraduates must be involved in an affirming environment where they are engaged at a high intellectual level and truly challenged so they are ready for the work yet to be done. *** **The MONA Collaboration has now established itself as a powerful collaboration with a strong track record in training undergraduate students to do research and produce peer reviewed articles in nuclear physics [add references including CEU posters ...].** *** // —> COMMENTS

Outcomes

Since the start of this collaboration, more than 100 undergraduate students from over 25 different colleges and universities as well as a few high school students have been actively involved in building, testing, and operating the MoNA and LISA detectors (see Section 7).

These diverse undergraduate students have worked with one another in assembling and testing MoNA and LISA and in operating it during experiments. They have pulled shifts and put in the long hours that are characteristic of work in experimental nuclear physics. The graduate stu-

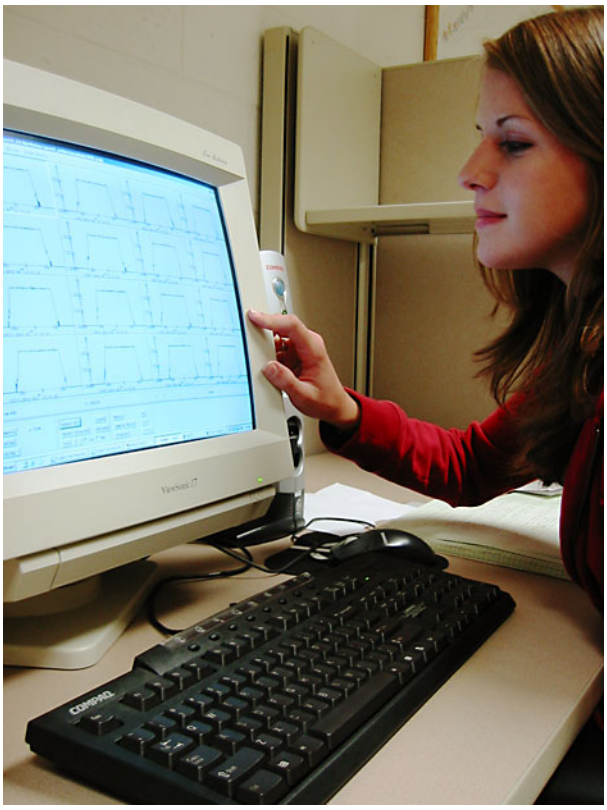

Figure 13: Undergraduate Tina Pike developing a calibration routine for MoNA.

dents and post docs at the NSCL provide approachable role models for them, and they feel free to ask questions of any of the faculty members in the group. For students from small undergraduate physics departments, participation in the MoNA collaboration provides a chance to experience the way physics is done in a large graduate physics department and at a world-class nuclear physics laboratory. The experience is particularly important for students who do not go on to graduate school in physics because they gain an understanding of how hard experimental scientists work to uncover the data points that underpin the theories written up in science texts and news magazines. The support of physics students who do not work as nuclear physicists but have careers in industry, K-12 education, or even the arts is important in reaching the non-scientists who control the funding for nuclear physics.

Distributed analysis

A feature of the MoNA collaboration that is an outgrowth of our collective work with undergraduate researchers is the emphasis on doing more than detector assembly or running shifts. In particular, the collaboration has a mechanism in place that allows the undergraduates to carry out the actual data analysis of the experiments.

One mode is that a student, with guidance from their mentor and the collaboration, has the primary responsibility for the analysis much like a traditional graduate student; other students may be involved but that student does much of the work and oversees and integrates the work of others. Students can work with more senior researchers where they provide hours on task and have a good overview of the experiment but do not have the ultimate responsibility for the results. Undergraduate students with limited time for work can still participate by working on very focused aspects such as the calibration of a single detector subsystem, code checking, or validation of the work of others (Figure 13).

Lastly, some collaboration members have undertaken the difficult task of improving the analysis algorithms and extending the detailed understanding of operations. MoNA undergraduate students at Westmont College have developed an algorithm to distinguish neutron multiplicity based on the kinematic propagation properties of neutrons though MoNA. Initial analysis of several one- and two-neutron experiments show promise. Scatter plots of neutron velocity and energy deposition versus scattering angle reveal a locus of points in which single-neutron events lie. Multiple-neutron events show as relatively uniform scatter throughout the plots, as there is no correlation between each individual neutron interaction in those instances besides the kinematics of the breakup which produced them.

There have not been instances where students wanted to be involved but were not. Undergraduate work has contributed to a number of publications and presentations (see Section 6).

We are able to involve undergraduate students in this way because we have the tradition of expecting such work from our students but also because of the collaboration infrastructure that is in place. Frankly, it would be difficult for single researchers from a primarily undergraduate institution to work successfully with their students on the analysis of such measurements in isolation. The fact that those involved participate in regular video-conferences where recent results and problems can be discussed with others also working on the same experiment or related analyses is crucial. The expertise that comes to the table in this fashion makes the group effort very strong.

Giving the students responsibility for the analysis in these ways additionally results in increased effectiveness during the actual experiments. They are much more involved and make significant contributions by doing preliminary analysis as the data is being recorded.

But the largest benefit to this type of undergraduate involvement is that they are enthused to continue on to graduate study and they are extremely well prepared to continue in research. They have mastered many fundamental research skills and understand the problem solving process that is essential to carry research through to a conclusion. In fact, the MoNA collaboration has dramatically impacted the interest of undergraduate students in pursuing physics graduate school with an emphasis in

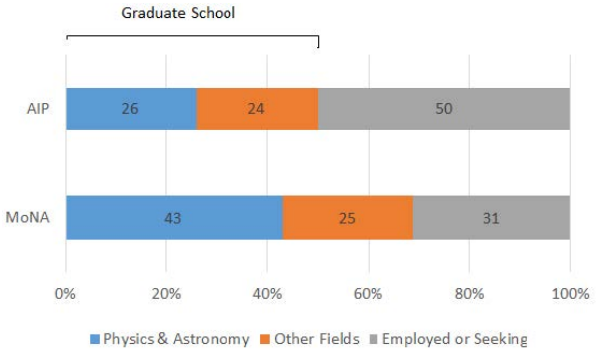

Figure 14: Career choices of BS/BA graduates from bachelor?s granting institutions in the U.S. from an AIP survey [19] and from the MoNA collaboration. The AIP data is from 1974 respondents from 2011 and 2012, and the MoNA data is based on 97 students from 2002 ? 2014.

nuclear physics (Figures 14 and 15).

The MoNA collaboration has had a significant national impact regarding the increase of the STEM workforce. The current job and geographic distribution of students are shown in Figures 16 and 17: about 70% of the students go into graduate school or are pursuing a STEM career.

Summer research

Summer is still the best time for undergraduates to get involved in major research projects. In addition to the undergraduate students from the collaborating institutions, many REU students joined the research efforts during the summers. The collaboration used this opportunity for workshops to teach the students about all aspects of MoNA. These workshops include formal presentations and mini-lectures on the experimental details and pertinent background material such as radioactive beam production, laboratory safety, and experimental electronics. These duties are shared amongst the collaboration's undergraduate professors and NSCL staff. The talks last an hour and a half each morning and then the students are put to work—finishing preparations, calibrating, and testing components—throughout the afternoon and into the evening. This intense and rigorous training period typically lasts for two weeks and culminates with an experiment that employs a lot of what the students just learned. At the end of the three week session, the students return to their summer obligations or begin analyzing the data from the experiment. Several of these students, well prepared by the MoNA Summer Session, return during the school year to help with other experiments.

Collaboration retreat

Near the end of each summer the MoNA collaboration has historically held a retreat at the Central Michigan Biological Station on Beaver Island, located in the northern tip of Lake Michigan. In 2014, the retreat was held at Michigan State University and in 2015, the retreat was

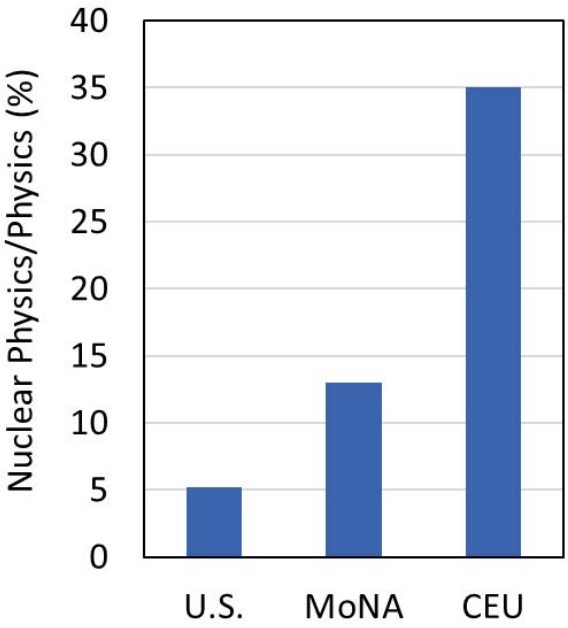

Figure 15: Fraction of graduate students in Nuclear Physics. The U.S. fraction corresponds to the average number of PhDs from 2000 ? 2012 [20].

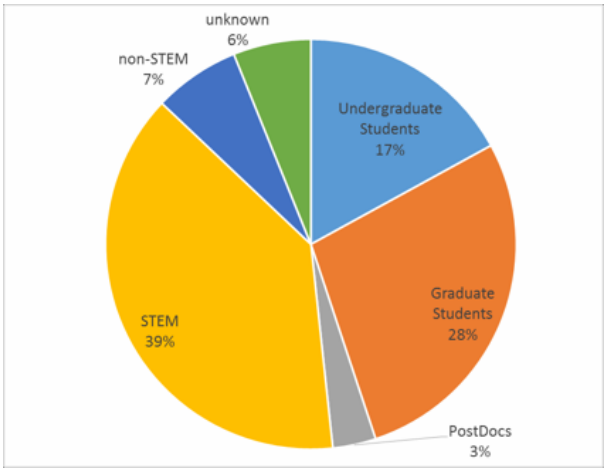

Figure 16: Present job distribution of all current and past MoNA students. 29 students are still in college, 48 students are currently in graduate school, 5 are PostDocs, 62 are employed in STEM fields, 12 are in non-STEM fields, and the status of 7 past students is unknown.

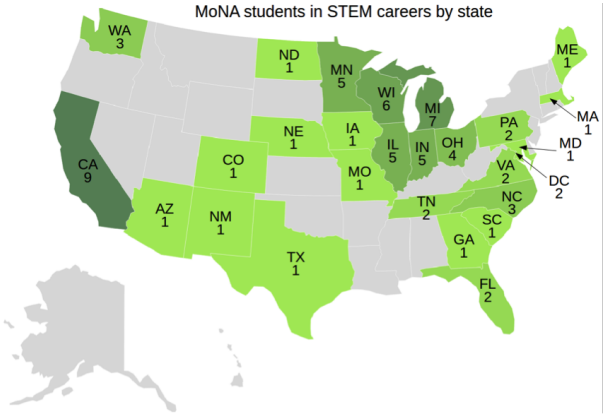

Figure 17: Geographic distribution of former MoNA students employed in STEM disciplines in the USA. 68 students work in the US and 2 students working in the UK and Malawi.

Figure 18: Participants of the 2012 Beaver Island retreat.

held at Westmont College in Santa Barbara, CA. Faculty and students participate in this annual gathering to write papers, discuss analysis, develop proposals for experiments and external support, and plan for the year ahead (Figure 18).

At the 2005 Beaver Island retreat a proposal was developed and subsequently received funding of $50,000 from the Research Excellence Fund of Michigan to purchase digital video-conferencing equipment. In addition to the specific needs of the MoNA collaboration that this hardware is intended to address, the video-conferencing infrastructure has offered substantial benefits to individual student and faculty participants at the member undergraduate institutions, to these institutions themselves, to the collaboration, and to the broader profession.

The equipment has allowed undergraduate students to participate in the real-time acquisition and off-line analysis of data. This novel remote approach to doing physics will give students the opportunity to participate in MoNA experiments together with other collaborators from multiple off-site locations and from the NSCL. Students are no longer prevented from participating in an experiment due to academic-year course commitments or travel constraints. The digital video conferencing system also allows faculty and students to have regular group, subgroup and point-to-point meetings where pre-experiment planning is being discussed and post-experimental data analysis is coordinated. The system is further being used for training, educating and motivating students who are new to the project. The system compliments the other forms of communication used by the collaboration, such as databases, websites, phones, and e-mail.

Data analysis and real-time experimental participation, facilitated by the conferencing system, will help students to foster stronger and more confident ties to the MoNA collaboration. This aspect of regular collaborative face-to-face interaction with members of the MoNA collaboration will continue to allow students to be genuine members of the group and contribute to the physics results produced by the collaboration.

Why undergraduate participation works so well with MoNA at NSCL

The MoNA collaboration has found it very easy to involve students in the fragmentation studies at NSCL. The students can readily grasp the basic goals of the measurements. As stated above, the academic atmosphere works well for the faculty and the undergraduate students fit in well (they especially relate to the graduate students), but additionally, the physics is easy for the students to understand. The reconstruction of the original nuclear mass is based on relativistic four-vectors. The nuclear shell model and single particle states, while complex in detail, can easily be related to atomic shells. The students are able to see the big picture while being involved in the experimental detail. Students see moderately complex detector systems but which are actually easily understood. (The concept of determining neutron energy from time-of-flight can be understood by first-year students.) The physics based on fragmentation provides tremendous opportunities for the undergraduate researcher (and their mentors).

In no small measure, the MoNA collaboration has been able to successfully and meaningfully involve undergraduates because the NSCL is an academic setting. The significant interaction of the undergraduate students with the graduate students and senior researchers, that are also instructors, has been very beneficial. The undergraduates are always greatly affirmed and encouraged. The mentors of these students also appreciate the support received from fellow academics.

4 Conclusion

A great deal of cutting edge physics remains to be done utilizing fast fragmentation beams. The evolution of shell closures (magic numbers) as the stabilizing influence of protons in the same orbitals is lost for the most neutron-rich nuclei, which continues to be of particular interest.

An additional focus is the study of neutron pairing correlations, which can be studied using neutron-rich nuclei in which sequential two-neutron decay is energetically forbidden, and only direct two-neutron decay can occur. Moreover, reaction studies and cross-section measurements can reveal, e.g., neutron and radiative strength functions. Reactions on exotic nuclei involving neutrons are also often of importance for explosive scenarios in astrophysics.

Many of these neutron-rich nuclei will be accessible at sufficient intensities and at nearly optimal beam velocities as fragmentation beams at a facility like FRIB.

The MoNA collaboration has been able to take advantage of the varying areas of expertise of its members to create a collaboration which has effectively involved undergraduate students from its beginning and continues to do so to this day. Students readily understand the nature of these experiments, and can participate in meaningful ways. The impact on these students of exposure to the international-level research currently conducted at NSCL is significant, and helps to train the next generation of physicists. A future isotope research facility that could continue this excellent support of undergraduate research would be welcomed by the MoNA collaboration, and would be an asset for our field of research.

5 Previous Director's Statements

The MoNA Collaboration consists of a group of researchers, most from primarily undergraduate institutions, who are pursuing studies of nuclei close to and beyond the neutron dripline using the Modular Neutron Array (MoNA). These experiments can only be done with neutron-rich nuclei produced via projectile fragmentation, as carried out, for example, at the National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University, where MoNA is currently located.

Since the first detectors of MoNA arrived for assembly in 2002, 64 undergraduate and high school students (as of Spring 2007) have participated in cutting-edge research in nuclear physics as part of the MoNA Collaboration. These students have assembled and tested the components of MoNA, participated in MoNA experiments and workshops at the NSCL and in the annual collaboration retreat, and played a central role in data analysis.

The MoNA collaboration has been a model for involvement of undergraduates in forefront research. The collaboration is committed to continuing its role in the study of nuclei at the limits of stability and in the training of the next generation of nuclear scientists. Our experience over the last six years leads us to the following observations:

- Studies of nuclei at the neutron dripline utilizing beams produced by fast fragmentation produce cutting-edge science. These experiments are well suited to meaningful participation by undergraduate students in a multi-institution collaboration.
- The collaboration has thrived in a university setting, where undergraduate education is at the core of the institutional mission.

We look forward to a next generation facility for rare-isotope beams which would ensure the continuation of this successful scientific and educational collaboration for years to come.

Jerry Hinnefeld
Executive Director, the MoNA collaboration
South Bend, January 17, 2007

Since the last version of this document the MoNA Collaboration has continued to thrive and grow. More than 100 undergraduate students have now been part of the collaboration's scientific endeavors playing vital roles in the study of the nuclei at the limits of stability. Our collaboration has grown in other ways as well. New institutions and investigators have joined the collaboration. Sharon L. Stephenson (Gettysburg College), Nathan Frank (Augustana College in Rock Island, IL), Artemis Spyrou (Michigan State University), Robert A. Kaye (Ohio Wesleyan University) and Deseree Meyer Brittingham (Rhodes College) are bringing new skills and insights to the collaboration's work. In addition a new detector system is under construction by undergraduates at the collaboration schools. LISA, the Large multi-Institution Scintillator Array, will work in conjunction with MoNA to increase our ability to measure angular distributions of reaction neutrons as well as improve the resolution and efficiency of detection in our experiments.

The MoNA Collaboration has always been forward-looking whether in the preparation of the next generation of physicists or in the construction of detectors that are ready for use in the next generation of rare isotope beam facilities (FRIB). Today, we see a bright future for the collaboration, the NSCL, and rare-isotope physics.

Bryan A. Luther
Executive Director of the MoNA Collaboration
Moorhead, MN, Sept. 9, 2010

In the last two years, the MoNA Collaboration has completed LISA, the Large multi-Institutional Scintillator Array. Twenty-three undergraduates worked on construction, testing, and installation of LISA, with additional students playing key roles in data analysis. A successful commissioning experiment in June 2011 continues our scientific program of probing nuclei at the limits of stability. The higher efficiency and better resolution

of MoNA LISA combined will allow the collaboration to study a wide array of isotopes that will be available when the Facility for Rare Ion Beams (FRIB) comes online. Extensive, meaningful undergraduate involvement in the cutting-edge science provides pivotal research experiences for students and contributes to training the next generation of nuclear scientists. The collaboration continues to exemplify a successful partnership between primarily undergraduate institutions and a large research university. We are excited about future research and educational opportunities that will be possible with FRIB and as our collaboration continues to grow.

Deseree Meyer Brittingham
Executive Director, the MoNA Collaboration
Beaver Island, MI, August 20, 2011

The MoNA Collaboration has continued to demonstrate growth in its scientific and educational objectives and outcomes since the production of the last White Paper. Since the beginning of 2012, 15 papers in refereed journals were published collectively by the collaboration, including cutting-edge studies of the ground-state dineutron decay of 16Be and two-neutron radioactivity in the decay of ^{26}O. A hodoscope particle detector array, intended to increase the sensitivity of the identification of charged fragments, was developed by Augustana College and was implemented in a commissioning experiment at the NSCL last summer. Paul Gueye (Hampton University) has joined the collaboration and is involved in an effort to develop a segmented target, which will determine the location of nuclear reactions within the reaction target and thus provide better resolution in decay energy measurements. Additionally, our mission to help educate the next generation of scientists remains an important cornerstone of our work. Two NSCL graduate students received their Ph.D. in MoNA-related research and over 20 undergraduates from across the participating institutions of the collaboration were involved in research projects in 2012–2013. We also continue to keep a keen eye to the future, making preparations for our experimental program to be a possible "Day One" user of the new Facility for Rare Isotope Beams (FRIB), currently slated for completion in 2022.
Robert Kaye
Executive Director, the MoNA Collaboration
Beaver Island, MI, August 17, 2013

The MoNA (Modular Neutron Array) Collaboration continued to find success over the past year. To date, we have 37 peer reviewed papers with over half of those having undergraduate students as co-authors. In 2014 three graduate students completed their PhDs and another has data in hand to study the energy gap between the sd Űpf neutron shells in ^{25}O. This year the total number of MoNA Collaboration undergraduate students has surpassed our lucky number of 144 Ű the number of neutron detectors in MoNA or LISA. Our 147 undergraduate students have presented over fifty times at national physics conferences. The infrastructure of the MoNA Collaboration and the tradition of expecting quality work from our students at all levels of their academic careers has led to our improving research opportunities and preparing the next generation of physicists.
Sharon Stephenson
Executive Director, the MoNA Collaboration
East Lansing, MI July 20, 2014

6 Presentations, publications, experiments, grants

Invited talks

1. The Modular Neutron Array at the NSCL
   T. Baumann for the MoNA Collaboration
   CAARI 2002: 17th International Conference on the Application of Accelerators in Research and Industry, CAARI, Denton TX, November 12–16, 2002

2. The MoNA project: doing big science projects with small-college undergraduates
   B. Luther
   APS April Meeting, Denver, CO, April 21–23, 2004; Bull. Am. Phys. Soc. 49, No. 2, 152 (2004)

3. Explorations of the driplines and first results from MoNA
   M. Thoennessen
   International Conference on Frontiers In Nuclear Structure, Astrophysics, and Reactions (FINUSTAR), Kos, Greece, September 12–17, 2005

4. Studies of neutron-rich nuclei with the MoNA/Sweeper system at the NSCL
   P. A. DeYoung
   APS April Meeting, Dallas, TX, April 22–25, 2006; Bull. Am. Phys. Soc. 51, No. 2, 24 (2006)

5. First excited state of doubly-magic ^{24}O
   A. Schiller, N. Frank, T. Baumann, J. Brown, P. DeYoung, J. Hinnefeld, R. Howes, J.-L. Lecouey, B. Luther, W. A. Peters, and M. Thoennessen
   Nuclear Structure 2006, Oak Ridge, TN, July 24–28, 2006; Book of Abstracts, Nuclear Structure 2006, Oak Ridge, p. 144 (2006)

6. Unbound states of neutron-rich oxygen isotopes
   M. Thoennessen, T. Baumann, D. Bazin, J. Brown, P. A. DeYoung, J. E. Finck, N. Frank, A. Gade, J. Hinnefeld, C. R. Hoffman, R. Howes, J.-L. Lecouey, B. Luther, W. A. Peters, W. F. Rogers, H. Scheit, A. Schiller, S. L. Tabor, MoNA Collaboration
   9th Int. Spring Sem. on Nucl Phys., Changing Facets of Nuclear Structure, Vico Equense, Italy, May 20–24, 2007; Abstracts, p. 2 (2007)

7. Unbound states of neutron-rich oxygen isotopes: Investigation into the N = 16 shell gap
   C. R. Hoffman, T. Baumann, D. Bazin, J. Brown, P. A. DeYoung, J. E. Finck, N. Frank, A. Gade, J. Hinnefeld, R. Howes, B. Luther, W. A. Peters, W. F. Rogers, H. Scheit, A. Schiller, S. L. Tabor, M. Thoennessen, MoNA Collaboration
   International Nuclear Physics Conference, INPC 2007, Tokyo, Japan, June 3–8, 2007; Program Book, F5-1, p. 14 (2007)

8. Unbound states of neutron-rich oxygen isotopes
   M. Thoennessen, T. Baumann, D. Bazin, J. Brown, P. A. DeYoung, J. E. Finck, N. Frank, A. Gade, J. Hinnefeld, C. R. Hoffman, R. Howes, J.-L. Lecouey, B. Luther, W. A. Peters, W. F. Rogers, H. Scheit, A. Schiller, S. L. Tabor, MoNA Collaboration
   International Conference on Proton Emitting Nuclei and Related Topics, PROCON07, Lisbon, Portugal, June 17–23, 2007; Abstracts, p. 54 (2007)

9. Unbound states of neutron-rich oxygen isotopes
   C. Hoffman
   JUSTIPEN-EFES workshop on shell structure of exotic nuclei 4th workshop by the DOE project JUSTIPEN and the JSPS core-to-core project EFES, RIKEN, Tokyo, Japan, June 23, 2007

10. Unbound states of neutron-rich oxygen isotopes: Investigation into the N = 16 shell gap
    C. R. Hoffman, T. Baumann, D. Bazin, J. Brown, P. A. DeYoung, J. E. Finck, N. Frank, A. Gade, J. Hinnefeld, R. Howes, B. Luther, W. A. Peters, W. F. Rogers, H. Scheit, A. Schiller, S. L. Tabor, M. Thoennessen, MoNA Collaboration
    International Conference on Nuclear Structure: Nuclear Structure: New Pictures in the Extended Isospin Space, Yukawa Institute for Theoretical Physics, Kyoto University, Kyoto, Japan, June 11–14, 2007; Book of Abstracts, p. 43 (2007)

11. Unbound states of neutron-rich oxygen isotopes: Investigation into the N = 16 shell gap
    C. Hoffman
    Direct Reactions with Exotic Beams, RIKEN, Tokyo, Japan, May 30–June 2, 2007

12. Proton knock-out reactions to neutron unbound states
    M. Thoennessen
    Workshop on Future Prospects for Spectroscopy and Direct Reactions, Michigan State University, East Lansing, MI, February 26–28, 2008

13. Investigating the N = 16 shell closure at the oxygen dripline
    C. Hoffman
    Nuclear Structure 2008, Michigan State University, East Lansing, MI, June 3–6, 2008

14. Neutron-decay spectroscopy of neutron-rich oxygen isotopes
    M. Thoennessen, C. R. Hoffman, T. Baumann, D. Bazin, J. Brown, G. Christian, P. A. DeYoung, J. E. Finck, N. Frank, J. Hinnefeld, R. Howes, P. Mears, E. Mosby, S. Mosby, J. Reith, B. Rizzo, W. F. Rogers, G. Peaslee, W. A. Peters, A. Schiller, M. J. Scott, S. L. Tabor, P. J. Voss, and T. Williams
    5th International Conference ENAM08 on Exotic Nuclei and Atomic Masses, Ryn, Poland September 7–13, 2008; Abstracts, p. 30 (2008)

15. Spectroscopy of unbound states at the oxygen drip line
    C. Hoffman
    Unbound Nuclei Workshop, INFN, Pisa, Italy, November 3–5, 2008

16. Big physics and small colleges: The mongol horde model of undergraduate research
    B. Luther
    AAPT Winter Meeting, Chicago, IL, Feb. 12–16, 2009; Program Guide, BA03, p. 47 (2009)

17. Exploration of the neutron drip-line at the NSCL
    M. Thoennessen
    Annual NuSTAR Meeting, March 23–27, 2009, GSI, Darmstadt, Germany

18. Explorations of the driplines
    M. Thoennessen
    Step Forward to FRIB, RIA/FRIB Workshop, May 30–31, 2009, Argonne, IL

19. Shell evolution at the oxygen drip line
    C. Hoffman
    VIII Latin American Symposium on Nuclear Physics and Applications, Universidad de Chile, Santiago, Chile, December 15–19, 2009

20. Unbound systems along the neutron drip line
    A. Spyrou
    Workshop on Perspectives on the modern shell model and related experimental topics, Michigan State University, East Lansing, MI, February 4–6, 2010

21. Dissertation award in nuclear physics
    C. Hoffman
    American Physical Society April Meeting, Washington, D. C., February 13–16, 2010

22. Exploration of the neutron dripline and discovery of new isotopes
    M. Thoennessen
    Carpathian Summer School of Physics 2010, June 20–July 3, 2010, Sinaia, Romania

23. Beyond the driplines with nuclear reactions
    M. Thoennessen
    24th International Nuclear Physics Conference, July 4–9, 2010, Vancouver, Canada

24. Undergraduate research with the MoNA Collaboration at the National Superconducting Cyclotron Laboratory
    B. Luther
    21st International Conference on the Application of Accelerators in Research and Industry, CAARI, Fort Worth, TX, Aug. 8–13, 2010

25. Neutron decay spectroscopy at and beyond the limit of stability
    A. Spyrou
    The Limits of Existence of Light Nuclei, ECT* Workshop, October 25–30, 2010, Trento, Italy

26. Nuclear structure physics with MoNA-LISA
    S. L. Stephenson, J. A. Brown, P. A. DeYoung, J. E. Finck, N. H. Frank, J. D. Hinnefeld, R. A. Kaye, G. F. Peaslee, D. A. Meyer, W. F. Rogers, and the MoNA Collaboration
    19th International Seminar on Interaction of Neutrons with Nuclei: Fundamental Interactions & Neutrons, Nuclear Structure, Ultracold Neutrons, Related Topics, JINR, Dubna, Russia, May 25–28, 2011

27. New experimental work on structure beyond the neutron drip-line
    A. Spyrou
    Nuclear Chemistry Gordon Research Conference, Colby-Sawyer College, New London, NH, June 12–17, 2011

28. Going beyond the dripline with MoNA-LISA
    M. Thoennessen
    1st Topical Workshop on Modern Aspects in Nuclear Structure Advances in Nuclear Structure with arrays including new scintillator detectors, February 22–25, 2012, Bormio, Italy

29. Exploration of light unbound nuclei
    M. Thoennessen
    Zakopane Conference on Nuclear Physics, August 27–September 2, 2012, Zakopane, Poland

30. Correlated two-neutron emission of nuclei beyond the neutron dripline
    M. Thoennessen
    4th International Conference on Collective Motion in Nuclei under Extreme Conditions COMEX 4, October 22–26, 2012, Shonan Village Center, Kanagawa, Japan

31. Recent results from MoNA-LISA
    Artemisia Spyrou
    D12.00003, American Physical Society April Meeting, Atlanta, GA, Bull. Am. Phys. Soc. 57 (2012)

32. Nuclear structure physics beyond the neutron drip line
    Artemisia Spyrou
    1WA.00001, Division of Nuclear Physics Fall Meeting, Newport Beach, CA, Bull. Am. Phys. Soc. 57 (2012)

33. Evidence for the ground-state resonance of ^{26}O
    Zachary Kohley
    Direct Reactions with Exotic Beams (DREB) Workshop, Pisa, Italy, March 2012

34. Nuclear structure along the neutron drip line
    A. Spyrou
    8^{th} Balkan School on Nuclear Physics, Bulgaria, July 3-12, 2012

35. Nuclear structure experiments beyond the neutron drip line
    Michael Thoennessen
    International Nuclear Physics Conference (INPC2013), Florence Italy, 2 - 7 June 2013

36. Measuring oxygen isotopes beyond the neutron dripline: Two-neutron emission and radioactivity
    Zachary Kohley
    APS Division of Nuclear Physics Fall Meeting, Newport News, VA, October, 2013

37. Simulation of a novel active target for neutron-unbound state measurements
    Nathan Frank Abstract DJ.00009, APS Division of Nuclear Physics Fall Meeting, Newport News, VA, October, 2013

38. Structure and decay correlations of two-neutron unbound systems beyond the dripline
    Zachary Kohley
    State of the Art in Nuclear Cluster Physics Workshop (SOTANCP3), Yokohama, Japan, May 2014

39. Three-body forces in two neutron decay experiments
    A. Spyrou
    ECT* Workshop: “Three-body forces: From Matter to Nuclei” Trento, Italy, 5-9 May, 2014

40. Study of neutron-unbound states with MoNA-LISA
    M. Thoennessen
    8^{th} International Workshop on Direct Reactions with Exotic Beams, June 30 - July 4, 2014, Darmstadt, Germany

41. Recent results from MoNA-LISA
    M. Thoennessen
    VII International Symposium on Exotic Nuclei, September 7-12, 2014, Kaliningrad, Russia

42. Neutron-unbound nuclei
    M. Thoennessen
    4^{th} Joint Meeting of the APS Division of Nuclear Physics and the Physical Society of Japan, Oct. 7-11, 2014, Waikoloa, HI

Abstracts of talks and posters at conferences

1. MONA: The Modular Neutron Detector
   B. Luther, T. Baumann, M. Thoennessen, J. Brown, P. DeYoung, J. Finck, J. Hinnefeld, R. Howes, K. Kemper, P. Pancella, G. Peaslee, and W. Tabor
   Abstracts, 10th Symposium on Radiation Measurements and Applications, p. 58 (2002)

2. Improving neutron detection efficiency by using passive converters
   T. Baumann, H. Ikeda, M. Kurokawa, M. Miura, T. Nakamura, Y. Nishi, S. Nishimura, A. Ozawa, T. Sugimoto, I. Tanihata and M. Thoennessen
   Abstracts, 10th Symposium on Radiation Measurements and Applications, p. 59 (2002)

3. MONA: The Modular Neutron Detector
   B. Luther, T. Baumann, M. Thoennessen, J. Brown, P. DeYoung, J. Finck, J. Hinnefeld, R. Howes, K. Kemper, P. Pancella, G. Peaslee, and S. Tabor
   Program of the Conference on Frontiers of Nuclear Structure, FNS2002, p. 109, LBNL-50598 Abs. (2002)

4. Construction of a Modular Neutron Array (MoNA)—A multi-college collaboration
   W. F. Rogers, T. Baumann, J. Brown, P. DeYoung, J. Finck, J. D. Hinnefeld, R. Howes, K. Kemper, B. A. Luther, P. Pancella, G. F. Peaslee, S. Tabor, M. Thoennessen
   Bull. Am. Phys. Soc. 47, No. 6, 27 (2002)

5. The status of the MoNA project
   T. Baumann, MoNA Collaboration
   Bull. Am. Phys. Soc. 48, No. 8, 47 (2003)

6. MoNA: Detector development as undergraduate research
   Ruth Howes
   Workshop on Detector Development, Bloomington, IN, May 30, 2003

7. FPGA-based trigger logic for the Modular Neutron Array (MoNA)
   T. Baumann, P. A. DeYoung, MoNA Collaboration
   Bull. Am. Phys. Soc. 49, No. 2, 181 (2004)

8. Commissioning of the MSU/FSU sweeper magnet
   N. Frank, M. Thoennessen, W. A. Peters, T. Baumann, D. Bazin, J. DeKamp, L. Morris, D. Sanderson, A. Schiller, J. Yurkon, A. Zeller, R. Zink
   Bull. Am. Phys. Soc. 49, No. 6, 20 (2004)

9. Characteristics and preliminary results from MoNA at MSU/NSCL
   W. A. Peters, N. Frank, M. Thoennessen, T. Baumann, J. Brown, D. Hecksel, P. DeYoung, T. Pike, J. Finck, P. Voss, B. Luther, M. Kleber, J. Miller, R. Pipen, W. Rogers, L. Elliott, M. Strongman, K. Watters, MoNA Collaboration
   Bull. Am. Phys. Soc. 49, No. 6, 20 (2004)

10. How undergraduates from four-year departments can do “big” physics
    R. Howes for the MoNA Collaboration
    The Announcer 34, No. 4, 93 (2004)

11. Excitation and decay of neutron-rich Be isotopes
    W. Peters, MoNA Collaboration
    Book of Abstracts, International Conference on Direct Nuclear Reactions with Exotic Beams, DREB05 (2005)

12. Ground state wave function of ^{12}Be
W. A. Peters, T. Baumann, N. Frank, J.-L. Lecouey, A. Schiller, M. Thoennessen, K. Yoneda, P. DeYoung, G. Peaslee, J. Brown, K. Jones, B. Luther, and W. Rogers
Bull. Am. Phys. Soc. 50, No. 6, 85 (2005)

13. Search for the first excited state of ^{24}O
N. Frank, P. G. Hansen, J.-L. Lecouey, W. A. Peters, A. Schiller, C. Simenel, J. R. Terry, M. Thoennessen, K. Yoneda, P. DeYoung, J. Brown, J. Hinnefeld, R. Howes, R. A. Kryger, B. Luther
Bull. Am. Phys. Soc. 50, No. 6, 86 (2005)

14. First excited state of doubly-magic ^{24}O
N. Frank, A. Schiller, T. Baumann, J. Brown, P. DeYoung, J. Hinnefeld, R. Howes, J.-L. Lecouey, B. Luther, W. A. Peters, M. Thoennessen
Bull. Am. Phys. Soc. 51, No. 6, 21 (2006)

15. Population of neutron-unbound states from direct fragmentation
G. Christian, D. Bazin, N. Frank, A. Gade, B. Golding, W. Peters, A. Ratkiewicz, A. Stump, A. Stolz, M. Thoennessen, M. Kleber, J. Miller, J. Brown, T. Williams, J. Finck, P. DeYoung, J. Hinnefeld, MoNA Collaboration
Bull. Am. Phys. Soc. 51, No. 6, 74 (2006)

16. Detection efficiency of the Modular Neutron Array
T. Baumann, W. A. Peters, MoNA Collaboration
Bull. Am. Phys. Soc. 51, No. 6, 103 (2006)

17. Cosmic muon detection using the NSCL Modular Neutron Array
W. F. Rogers, S. Mosby, S. Mosby, J. Gillette, M. Reese, MoNA Collaboration
Bull. Am. Phys. Soc. 51, No. 6, 103 (2006)

18. Study of Coulomb and nuclear dissociation for astrophysical neutron capture cross sections
A. Horvath, K. Ieki, A. Kiss, A. Galonsky, M. Thoennessen, T. Baumann, D. Bazin, C. A. Bertulani, C. Bordeanu, N. Carlin, M. Csanad, F. Deak, P. DeYoung, N. Frank, T. Fukuchi, Zs. Fulop, A. Gade, D. R. Galaviz, C. Hoffman, R. Izsak, W. A. Peters, H. Schelin, A. Schiller, R. Sugo, Z. Seres, and G. I. Veres
Book of Abstracts, IX International Conference on Nucleus Nucleus Collisions (NN2006), p. 236 (2006)

19. Ground state of ^{25}O and the first excited state of ^{24}O
C. R. Hoffman, S. Tabor, T. Baumann, D. Bazin, A. Gade, W. A. Peters, H. Scheit, A. Schiller, M. Thoennessen, J. Brown, P. A. DeYoung, J. E. Finck, J. Hinnefeld, R. Howes, N. Frank, B. Luther, MoNA Collaboration
Bull. Am. Phys. Soc. 52, No. 3, 198 (2007)

20. Unbound states of neutron-rich oxygen isotope
C. R. Hoffman, S. L. Tabor, M. Thoennessen, T. Baumann, D. Bazin, A. Gade, W. A. Peters, A. Schiller, J. Brown, P. A. DeYoung, R. Howes, N. Frank, B. Luther, H. Scheit, J. Hinnefeld, MoNA Collaboration
Bull. Am. Phys. Soc. 52, No. 9, 29 (2007)

21. Measurement of the ground state of ^{15}Be
A. Spyrou, T. Baumann, D. Bazin, G. Christian, S. Mosby, M. Strongman, M. Thoennessen, J. Brown, P. A. Deyoung, A. Deline, J. E. Finck, A. Russell, N. Frank, E. Breitbach, R. Howes, W. A. Peters, A. Schiller
Bull. Am. Phys. Soc. 53, No. 5, 114 (2008)

22. Investigating The N = 16 shell closure at the oxygen drip line
C. R. Hoffman, T. Baumann, D. Bazin, J. Brown, G. Christian, P. A. DeYoung, J. E. Finck, N. Frank, J. Hinnefeld, R. Howes, P. Mears, E. Mosby, S. Mosby, J. Reith, B. Rizzo, W. F. Rogers, G. Peaslee, W. A. Peters, A. Schiller, M. J. Scott, S. L. Tabor, M. Thoennessen, P. J. Voss, T. Williams
Book of Abstracts, 12th in series of nuclear structure 2008, Michigan State University, East Lansing, Michigan, June 3–6, 2008 p. 66 (2008)

23. Measurement of the efficiency of the Modular Neutron Array (MONA) at the NSCL
W. A. Peters, T. Baumann, M. Thoennessen, G. Christian, M. Strongman, N. Frank, P. A. DeYoung, A. Schiller
CAARI (2008)

24. Studying the structure of the neutron-unbound ^{12}Li
A. Spyrou, M. Thoennessen, P. A. DeYoung, C. C. Hall, and the MoNA Collaboration
Bull. Am. Phys. Soc. 53, No. 12, ED.00006 (2008)

25. Nuclear structure studies along the neutron drip line: The case of ^{22}N
A. Spyrou and the MoNA Collaboration
8th International Conference on Radioactive Nuclear Beams (RNB8), Grand Rapids, MI, USA, 26–30 May 2009

26. Studying the neutron unbound ^{18}B
A. Spyrou, T. Baumann, D. Bazin, G. Christian, S. Mosby, M. Strongman, M. Thoennessen, J. Brown, P. A. DeYoung, A. DeLine, J. E. Finck, A. Russel, N. Frank, E. Breitbach, R. Howes, W. A. Peters, A. Schiller, MoNA Collaboration
Bull. Am. Phys. Soc. 54, No. 10, LH.00004 (2009)

27. Disappearance of the N = 14 shell
M. J. Strongman, T. Baumann, D. Bazin, N. Frank, S. Mosby, W. A. Peters, A. Schiller, A. Spyrou, M. Thoennessen, C. R. Hoffman, S. L. Tabor, J. Brown, P. A. DeYoung, J. E. Finck, W. F. Rogers
Bull. Am. Phys. Soc. 54, No. 10, LL.00003 (2009)

28. Creating a collaboration to perform big science at small schools
Joseph E. Finck, Bryan Luther, and Graham Peaslee
CUR 13th Nation Conference, Undergraduate Research as Transformative Practice, June 19–22, 2010, Weber State University, Ogden UT

29. Impact of undergraduate research experiences on graduate research programs (panel discussion)
Michael Thoennessen
Bull. Am. Phys. Soc. 55, No. 1, April Meeting of the APS, Washington, D.C., G6.00004 (2010)

30. Spectroscopy of neutron-unbound fluorine isotopes
G. Christian, N. Frank, S. Ash, M. Warren, A. Gade, A. Spyrou, M. Thoennessen, T. Baumann, G. F. Grinyer, D. Weisshaar, P. A. DeYoung, MoNA Collaboration
Bull. Am. Phys. Soc. 55, No. 14, MG.00008 (2010)

31. Ground-state neutron decay of ^{21}C
S. Mosby, M. Thoennessen, P. DeYoung
Bull. Am. Phys. Soc. 55, No. 14, DC.00003 (2010)

32. Nuclear structure along the neutron dripline
A. Spyrou, MoNA Collaboration
Nuclear Structure 2010, Clark-Kerr Campus U. C. Berkeley, CA, 8–13 August 2010

33. Construction and testing of the Large multi-Institutional Scintillator Array (LISA) – A model of collaborative undergraduate research
Warren Rogers and the MoNA Collaboration
Bull. Am. Phys. Soc. 56, No. 4, B13.00004, APS Spring Meeting, Anaheim, CA (2011)

34. Spectroscopy of neutron unbound fluorine
Gregory Christian, N. Frank, S. Ash, M. Warren, A. Gade, A. Spyrou, M. Thoennessen, T. Baumann, G. F. Grinyer, D. Weisshaar, P. A. DeYoung, MoNA Collaboration
Bull. Am. Phys. Soc. 56, No. 4, B7.00005 (2011)

35. Measurement of excitation energy of neon prefragments
M. Mosby, D. J. Morrissey, M. Thoennessen
Bull. Am. Phys. Soc. 56, No. 12, ME.00004 (2011)

36. Spectroscopy of neutron unbound carbon isotopes
S. Mosby, M. Thoennessen, P. DeYoung
Bull. Am. Phys. Soc. 56, No. 12, JF.00002 (2011)

37. Spectroscopy of neutron-unbound ^{15}Be
Jesse Snyder, Michael Thoennessen, Thomas Baumann, Artemis Spryou, Michael Strongman, Greg Christian, Shea Mosby, Michelle Mosby, Jenna Smith, Anna Simon, Bryan Luther, Sharon Stephenson, Alex Peters, Paul DeYoung, Eric Lunderberg, Joseph Finck
Bull. Am. Phys. Soc. 56, No. 12, JF.00001 (2011)

38. Fast fragmentation studies with the MoNA and LISA neutron detectors
Joseph E. Finck and the MoNA Collaboration
XII International Symposium on Nuclei in the Cosmos, Cairns, Australia (August 5–10, 2012)

39. Unbound excited states in ^{28}Ne and ^{25}F
Jenna Smith, B. Alex Brown, Greg Christian, Shea Mosby, John F. Novak, Steven J. Quinn, Jesse Snyder, Artemis Spyrou, Michael J. Strongman, Michael Thoennessen, Thomas Baumann, Zachary Kohley, Joseph E. Finck, and Calem R. Hoffman
DD.00003, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2012)

40. Spectroscopy of neutron-unbound ^{15}Be
Jesse Snyder, Michael Thoennessen, Thomas Baumann, Artemis Spryou, Michael Strongman, Greg Christian, Shea Mosby, Michelle Mosby, Jenna Smith, Anna Simon, Bryan Luther, Sharon Stephenson, Alex Peters, Paul DeYoung, Eric Lunderberg and Joseph Finck
CD.00009, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2012)

41. The controversial ^{10}He ground state resonance: A new observation using a 2p2n-removal from ^{14}Be
Z. Kohley, J. Snyder and M. Thoennessen
CD.00005, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2012)

42. Simulation of a novel active target for neutron-unbound state measurements
Nathan Frank
Abstract DJ.00009, APS Division of Nuclear Physics Fall Meeting, Newport News, VA, October, 2013

43. Measuring the partial width of the ^{56}Ni proton-capture resonance through (d,n) with VANDLE and MoNA-LISA
William Peters, R. Grzywacz, M. Madurga, S. Paulauskas, S. Taylor, J. Allen. J.A. Cizewski, B. Manning, M.E. Howard, D.W. Bardayan, S.D. Pain, R.C.C. Clement, S. Ilyushkin, P.D. O'Malley, R. Ikeyama, R.L. Kozub, K.D. Long, Z.J. Bergstrom, P.A. DeYoung, W.F. Rogers, J. Smith, M. Jones, T. Baumann, M. Thoennessen
Abstract CF.00001, APS Division of Nuclear Physics Fall Meeting, Newport News, VA, October, 2013

44. 4n contributions in populating unbound ^{10}He from ^{14}Be
Michael Jones, Zach Kohley, Jesse Snyder, Thomas Baumann, Jenna Smith, Artemis Spyrou, Michael Thoennessen
Abstract PD.00004, APS Division of Nuclear Physics Fall Meeting, Newport News, VA, October, 2013

45. Two-neutron decay of excited states of ^{11}Li
J. Smith, MoNA Collaboration
Abstract PD.00007, APS Division of Nuclear Physics Fall Meeting, Newport News, VA, Bull. Am. Phys. Soc. 58, No. 13, 152 (2013)

46. Measurement of neutron knockout cross-section of ^{24}O to the ground-state of ^{23}O
D. Divaratne, C. Brune, P. King, H. Attanayake, S. Grimes, M. Thoennessen, D. Bazin, MoNA Collaboration
Abstract PD.00008, APS Division of Nuclear Physics Fall Meeting, Newport News, VA, Bull. Am. Phys. Soc. 58, No. 13, 152 (2013)

47. Two-neutron decay from the ground state of ^{26}O
H. Attanayake, P. King, C. Brune, D. Diaratne, MoNA Collaboration
Abstract PD.00009, APS Division of Nuclear Physics Fall Meeting, Newport News, VA, Bull. Am. Phys. Soc. 58, No. 13, 152 (2013)

48. A Multi-layered target for the study of neutron-unbound nuclei
Paul Gueye, Nathan Frank and Michael Thoennessen
D13.00002, American Physical Society Meeting, Denver, CO, Bull. Am. Phys. Soc. 58, No. 4, 67 (2013)

49. Measurement of neutron knockout cross section of ^{24}O to the ground-state of ^{23}O
D. Divaratne, C. Brune, P. King, H. Attanayake, S. Grimes, and M. Thoennessen
Annual Spring Meeting of the APS Ohio-Region Section, Athens OH, Bull. Am. Phys. Soc. 58, No. 2, D4.00003 (2013)

50. VANDLE-izing north america; first results from the versatile array of neutron detectors at low energy
W.A. Peters, M. Madurga, S. Paulauskas, R. Grzywacz, J.A. Cizewski, M.E. Howard, A. Ratkiwewicz, B. Manning, J. Blackmon, D.W. Bardayan, M.S. Smith, S. Ilyushkin, P.D. OŠMalley, F. Sarazin, T. Baumann, M. Thoennessen, P.A. DeYoung, R.R.C. Clement, E. Stech, and M. Wiescher
INPC2013 Book of Abstracts, NF070 (2013)

51. Experimental check of Coulomb dissociation method for neutron capture measurements
R. Izsak, A. Galonsky, A. Horvath, A. Kiss, Z. Seres, M. Thoennessen, C.A. Bertulani, Zs. Fulop, T. Baumann, D. Bazin, K. Ieki, C. Bordeanu, N. Carlin, M. Csanad, F. Deak, P. DeYoung, N. Frank, T. Fukuchi, A. Gade, D. Galaviz, C. Hoffman, W.A. Peters, H. Schelin, A. Schiller, R.

Sugo, and G.I. Veres
EuroGENESIS workshop on "Open problems and future directions in heavy element nucleosynthesis", Book of Abstracts, p. 31 (2013)

52. Determining the resonance strength of the ^{56}Ni *rp*-process waiting point through (d,n) with VANDLE and MoNA-LISA
W. Peters, R. Grzywacz, M. Madurga, S.V. Paulauskas, S. Taylor, J. Allen, J.A. Cizewski, B. Manning, M.E. Howard. J. Smith, M. Jones, T. Baumann, M. Thoennessen, D.W. Bardayan, S.D. Pain, R.C.C. Clement, J. Brown, B. Luther, S. Ilyushkin, P.D. O'Malley, R. Ikeyama, R.L. Kozub, Z.J. Bergstrom, P.A. DeYoung, W. Rogers
Abstract K6.00008, American Physical Society, Savannah, Georgia, April 2014

Abstracts of standard talks and posters at conferences by undergraduates

1. Accurate energy calibrations from cosmic ray measurements
A. DeLine, J. Finck, A. Spyrou, M. Thoennessen, and P. DeYoung
Poster presented at the 2008 April APS meeting, Bull. Am. Phys. Soc. 53, No. 5, 219, S18.00005 (2008)

2. Nuclear astrophysics outreach program now employs researcher's equipment for enhancement
Amy DeLine, Zach Constan, and Joseph Finck
Winter Meeting of the AAPT, Chicago, IL (2009)

3. Undergraduate experiences in cutting-edge research experiments
A. Haagsma, K. Rethman, MoNA Collaboration
Bull. Am. Phys. Soc. 55, No. 1, 97, poster G11.00003 (2010)

4. Spectroscopy of ^{13}Li
E. M. Lunderberg, C. C. Hall, P. A. DeYoung, M. Thoennessen, J. Snyder
Bull. Am. Phys. Soc. 56, No. 12, JF.00001 (2011)

Seminars and colloquia

1. MoNA: the Modular Neutron Array
Joseph E. Finck
Physics Department Seminar, Central Michigan University, Mount Pleasant, MI, October 25, 2001

2. Physics at the neutron dripline: The MoNA Project and the NSCL
Bryan Luther
Department of Physics Seminar, North Dakota State University, Fargo, ND, October 16, 2002

3. Giving students a taste of research
Bryan Luther
Department of Physics Seminar, North Dakota State University, Fargo, ND, October 16, 2002

4. The Coupled Cyclotron Facility and MoNA at the NSCL
Thomas Baumann
Triangle Universities Nuclear Laboratory Seminar, Durham, NC, November 21, 2002

5. MoNA: The Modular Neutron Array
Bryan Luther
Centennial Scholars Program, Moorhead, MN, February 11, 2003

6. Development of neutron detectors
Ruth Howes
Seminar at Mt. San Antonio College, Walnut, CA, March 28, 2003

7. MoNA: detector development as undergraduate research
Ruth Howes
Workshop on Detector Development, Bloomington, IN, May 30, 2003

8. MoNA and physics at the nuclear dripline
Ruth Howes
Colloquium at Marquette University, Milwaukee, WI, January 29, 2004

9. Status of the Modular Neutron Array, new opportunities near the neutron dripline
   James A. Brown
   Ball State University, Muncie, IN, November 11, 2004

10. Where the sidewalk ends: MoNA and the neutron dripline
    Bryan Luther
    Physics Department Colloquium, Carleton College, Northfield, MN, March 10, 2005

11. Exploring the neutron dripline with MoNA
    Michael Thoennessen
    Physics Department Colloquium, Argonne National Laboratory, Argonne, IL, February 3, 2006

12. Nuclear structure studies with the Modular Neutron Array
    James A. Brown
    Duke University, Triangle Universities Nuclear Structure Laboratory, Durham, NC, March 2, 2006

13. The Modular Neutron Array & the MoNA collaboration
    Thomas Baumann
    Physics Department Seminar, Central Michigan University, Mount Pleasant, MI, March 30, 2006

14. Selective population and neutron decay of the first excited state of semi-magic ^{23}O
    A. Schiller
    Nuclear Physics Seminar, Argonne National Laboratory, Argonne, IL, December 18, 2006

15. Physics with the Modular Neutron Array
    Joseph E. Finck
    Physics Department Seminar, Central Michigan University, Mount Pleasant, MI, January 11, 2007

16. Exploring the edge of the nuclear universe
    Michael Thoennessen
    Physics Department Colloquium, Smith College, Northampton, MA, February 17, 2007

17. Nuclear physics near the dripline: Present and future of MoNA
    Nathan Frank
    Physics Department Seminar, Central Michigan University, Mount Pleasant, MI, March 23, 2007

18. Exploring the edge of the nuclear universe
    Michael Thoennessen
    Seminar, Department of Biological & Physical Sciences, South Carolina State University, Orangeburg, SC, February 26, 2008

19. Studying exotic nuclei with the Modular Neutron Array (MoNA)
    Artemis Spyrou
    Seminar, Physics Department, Indiana University South Bend, November 13, 2008

20. Explorations of the driplines at the NSCL
    Michael Thoennessen
    College 3 Seminar, Institute Laue Langevin, Grenoble, France, November 21, 2008

21. Studying exotic nuclei with the Modular Neutron Array (MoNA)
    Artemis Spyrou
    Seminar, Department of Physics, Grand Valley State University, November 2, 2009

22. Discovery of new isotopes at and beyond the neutron dripline
    Michael Thoennessen
    Kernphysikalisches Kolloquium, Institut für Kernphysik, Universität zu Köln, Germany, February 3, 2010

23. Traveling beyond the neutron dripline with MoNA
    A. Spyrou
    Seminar given at Oakridge National Lab, June 2010

24. Physics at the neutron dripline
    Sharon Stephenson
    Physics Department Colloquium, Franklin and Marshall College, Lancaster, PA, October 13, 2011

25. Construction, testing, and installation of the Large Multi-Institutional Scintillator Array (LISA)
    D. A. Meyer
    University of Kentucky, Lexington, KY, 21 April 2011

26. Exploring the edge of the nuclear universe
    Michael Thoennessen
    Seminar, Dept. of Physics and Astronomy, Indiana University South Bend, South Bend, IN, February 10, 2011

27. Exploring the edge of the nuclear universe
    Michael Thoennessen
    Muller Prize Lecture, Ohio Wesleyan University, Delaware, OH, Feb. 22, 2011

28. Expanding the nuclear horizon
    Michael Thoennessen
    Department of Physics & Astronomy Colloquium, Stony Brook University, Stony Brook, NY, March 1, 2011

29. Expanding the nuclear horizon
    Michael Thoennessen
    iThemba Laboratory Colloquium, Stellenbosch, South Africa, March 8, 2011

30. Physics at the neutron dripline
    Sharon Stephenson
    Franklin and Marshall College, October 13, 2011

31. Undergraduate research in nuclear physics
    Nathan Frank
    Indiana University South Bend, South Bend, IN, March 8, 2012

32. MoNA-LISA and the rare, shortlived world of exotic nuclei
    Sharon Stephenson
    SUNY-Geneseo, April 12, 2012

33. Going beyond the neutron dripline: Recent measurements of two-neutron unbound nuclei
    Zachary Kohley
    Webinar for the Nuclear Science and Security Consortium, October 2012

34. First observation of ground state di-neutron decay: ^{16}Be
    A. Spyrou
    Seminar given at NSCL, February 2012

35. Nuclear structure along the neutron drip line: recent results of MoNA
    A. Spyrou
    Seminar at Argonne National Lab, April 2012

36. Nuclear structure along the neutron dripline
    A. Spyrou
    Colloquium at Fermi Lab, September 2012

37. Research on unstable atomic nuclei with undergraduates
    Nathan Frank
    Celebration of Scholarship at Augustana College, February 18, 2013

38. Neutron-rich nuclear physics at Michigan State University
    Jenna Smith
    Seminar, Indiana University - South Bend, March 28, 2013

39. Measuring oxygen isotopes beyond the neutron dripline: Two-neutron emission and radioactivity
    Zachary Kohley
    Australian National University, Canberra, Australia, November 2013

40. Measuring oxygen isotopes beyond the neutron dripline: Two-neutron emission and radioactivity
    Zachary Kohley
    Central Michigan University, Mount Pleasant, MI, September 2013

41. Studying Atomic Nuclei with Undergraduates,
    Nathan Frank
    Colloquium, Department of Physics, Hampton University, Hampton, VA, April 3, 2014

Undergraduate presentations: CEU posters

CEU, 2002 DNP Fall Meeting, East Lansing, MI

1. Veto detectors for the micro-modular neutron array
   Y. Lu, T. Baumann, M. Thoennessen, E. Tryggestad, M. Evanger, B. Luther, M. Rajabali, R. Turner
   Bull. Am. Phys. Soc. 47, No. 6, 48 (2002)

2. First radioactive beam experiment with the Modular Neutron Array MoNA
   M. Rajabali, M. Evanger, R. Turner, B. Luther, T. Baumann, Y. Lu, M. Thoennessen, E. Tryggestad
   Bull. Am. Phys. Soc. 47, No. 6, 54 (2002)

3. Neutron testing of the micro-Modular Neutron Array
   M. Evanger, M. Rajabali, R. Turner, B. Luther, T. Baumann, Y. Lu, M. Thoennessen, E. Tryggestad
   Bull. Am. Phys. Soc. 47, No. 6, 55 (2002)

4. Cosmic ray testing of the micro-Modular Neutron Array
   R. Turner, M. Evanger, M. Rajabali, B. Luther, T. Baumann, Y. Lu, M. Thoennessen, E. Tryggestad
   Bull. Am. Phys. Soc. 47, No. 6, 55 (2002)

5. The MoNA project
   P. J. VanWylen, J. P. Bychowski, P. A. DeYoung, G. F. Peaslee, The MoNA Consortium
   Bull. Am. Phys. Soc. 47, No. 6, 60 (2002)

CEU, 2003 DNP Fall Meeting, Tucson, AZ

1. Calibration of the Modular Neutron Array (MoNA)
   S. Clark, N. Walker, W. Rogers, T. Baumann, M. Thoennessen, A. Stolz, W. Peters
   Bull. Am. Phys. Soc. 48, No. 8, 51 (2003)

2. High voltage control of the Modular Neutron Array
   S. Marley, T. Baumann, N. Frank, E. Johnson, W. Peters, M. Thoennessen, B. Luther
   Bull. Am. Phys. Soc. 48, No. 8, 59 (2003)

3. Cosmic rays in MoNA
   E. Johnson, M. Thoennessen, T. Baumann, W. Peters, S. Marley, B. Luther
   Bull. Am. Phys. Soc. 48, No. 8, 61 (2003)

CEU, 2004 DNP Fall Meeting, Chicago, IL

1. Determination of position resolution for the Modular Neutron Array using cosmic rays
   J. Miller, M. Kleber, B. Luther, MoNA Collaboration
   Bull. Am. Phys. Soc. 49, No. 6, 60 (2004)

2. MoNA and initial measurements with ^{7}He resonance
   T. Pike, R. Pepin, MoNA Collaboration
   Bull. Am. Phys. Soc. 49, No. 6, 62 (2004)

3. Cosmic muon tracking with MoNA
   K. Watters, L. Elliott, M. Strongman, W. Rogers
   Bull. Am. Phys. Soc. 49, No. 6, 64 (2004)

4. Calibration of the Modular Neutron Array
   R. Pepin, T. Pike, MoNA Collaboration
   Bull. Am. Phys. Soc. 49, No. 6, 67 (2004)

CEU, 2005 DNP Fall Meeting, Maui, HI

1. Tracking single and multiple events in MoNA
   A. Stump, A. Ratkiewicz, MoNA Collaboration
   Bull. Am. Phys. Soc. 50, No. 6, 143 (2005)

2. MoNA calibration and neutron tracking
   S. Mosby, E. Mosby, W. F. Rogers, MoNA Collaboration
   Bull. Am. Phys. Soc. 50, No. 6, 143 (2005)

CEU, 2006 DNP Fall Meeting, Nashville, TN

1. An automated relative time calibration for MoNA
   D. Albertson, MoNA Collaboration
   Bull. Am. Phys. Soc. 51, No. 6, 48 (2006)

2. Analysis of kinematics and decay energy in the breakup of ^{7}He
   D. Denby, P. DeYoung, G. Peaslee, MoNA Collaboration
   Bull. Am. Phys. Soc. 51, No. 6, 52 (2006)

3. Calibration of the thick and thin scintillators for the NSCL/FSU Sweeper magnet system
   A. Hayes, MoNA Collaboration
   Bull. Am. Phys. Soc. 51, No. 6, 54 (2006)

4. Cosmic muon flux variations using the Modular Neutron Array
   E. Mosby, S. Mosby, J. Gillette, M. Reese, W. F. Rogers, MoNA Collaboration
   Bull. Am. Phys. Soc. 51, No.‘6, 58 (2006)

5. Neutron multiplicity discrimination in MoNA
   S. Mosby, E. Mosby, W. F. Rogers, MoNA Collaboration
   Bull. Am. Phys. Soc. 51, No. 6, 58 (2006)

CEU, 2007 DNP Fall Meeting, Newport News, VA

1. Search for upward cosmic rays
   E. White, A. Spyrou, M. Thoennessen, T. Yoast-Hull, MoNA Collaboration
   Bull. Am. Phys. Soc. 52, No. 9, 68 (2007)

2. Efficiency and multi-hit capability improvements of MoNA
   T. Yoast-Hull, A. Spyrou, M. Thoennessen, E. White, MoNA Collaboration
   Bull. Am. Phys. Soc. 52, No. 9, 69 (2007)

CEU, 2008 DNP Fall Meeting, Oakland, CA

1. Geant4 simulation of MoNA
   A. Fritsch, M. Heim, T. Baumann, S. Mosby, A. Spyrou
   Bull. Am. Phys. Soc. 53, No. 12, DA.00028 (2008)

2. Investigation of neutron scattering in the Modular Neutron Array (MoNA)
   M. Gardener, W. F. Rogers
   Bull. Am. Phys. Soc. 53, No. 12, DA.00030 (2008)

3. Experimental observation of decay energy of ^{12,13}Li
   C. Hall, P.A. DeYoung, S. Mosby, A. Spyrou, M. Thoennessen
   Bull. Am. Phys. Soc. 53, No. 12, DA.00037 (2008)

CEU, 2009 DNP Fall Meeting, Waikoloa, HI

1. Spectroscopy of ^{12}Li
   E. Lunderberg, C. Hall, P. DeYoung, A. Spyrou, M. Thoennessen, MoNA Collaboration
   CEU Poster GB0.00070, Bull. Am. Phys. Soc. 54, No. 10, 150 (2009) Division of Nuclear Physics Fall Meeting, Waikoloa, Hawaii (2009)

2. Observation of neutron-unbound resonant stated in ^{23}O and ^{28}Ne
   J. Novak, S. Quinn, M. Strongman, S. Mosby, A. Spyrou, T. Baumann, M. Thoennessen, and the MoNA Collaboration
   CEU Poster GB.00091, Bull. Am. Phys. Soc. 54, No. 10, 154 (2009)

3. Non-resonant neutron emission of excited neutron-rich nuclei
   S. Quinn, J. Novak, M. Strongman, S. Mosby, A. Spyrou, T. Baumann, M. Thoennessen, and the MoNA Collaboration
   CEU Poster GB.00100, Bull. Am. Phys. Soc. 54, No. 10, 155 (2009)

4. Accurate position calibration for charged fragments
   A. Russell, J. E. Finck, A. Spyrou, M. Thoennessen, and the MoNA Collaboration
   CEU Poster GB.00103, Bull. Am. Phys. Soc. 54, No. 10, 156 (2009)

CEU, 2010 DNP Fall Meeting, Santa Fe, NM

1. Testing the Large-area multi-Institutional Scintillator Array (LISA) neutron detector
   T. B. Nagi, K. M. Rethman, K. A. Purtell, A. J. Haagsama, C. DeRoo, M. Jacobson, S. Kuhn, A. R. Peters, M. Ndong, S. A.Stewart, Z. Torstrick, R. Anthony, H. Chen, A. Howe, N. S. Badger, M. D. Miller, B. J. Foster, L. C. Rice, B. C. Vest, A. B. Aulie, A. Grovom, L. Elliott, and P. Kasavan
   CEU Poster EA.00078, Division of Nuclear Physics Fall Meeting, Santa Fe, NM (2010)

2. Performance comparison of MoNA and LISA neutron detectors
   Kimberly Purtell, Kaitlynne Rethman, Autumn Haagsma, Joseph Finck, Jenna Smith, Jesse Snyder
   CEU Poster EA.00090, Division of Nuclear Physics Fall Meeting, Santa Fe, NM (2010)

3. Construction of the Large-area multi-Institutional Scintillator Array (LISA) neutron detector
   Kaitlynne Rethman, Kimberly Purtell, Autumn Haagsma, Casey DeRoo, Megan Jacobson, Steve Kuhn, Alexander Peters, Tim Nagi, Sam Stewart, Zack Torstrick, Mathieu Ndong, Rob Anthony, Hengzhi Chen, Alex Howe, Nicholas Badger, Matthew Miller, Brad Vest, Ben Foster, Logan Rice, Alegra Aulie, Amanda Grovom, Philip Kasavan, Lewis Elliott
   CEU Poster EA.00093, Division of Nuclear Physics Fall Meeting, Santa Fe, NM (2010)

4. Search for angular anisotropies in neutron emissions of fragmentation reactions with secondary beams
   Sam Novario, Greg Christian, Jenna Smith, Michael Thoennessen
   CEU Poster EA.00081, Division of Nuclear Physics Fall Meeting, Santa Fe, NM (2010)

5. Tagging the decay of neutron unbound states near the dripline
   Alissa Wersal, Greg Christian, Michael Thoennessen, Artemis Spyrou
   CEU Poster EA.00126, Division of Nuclear Physics Fall Meeting, Santa Fe, NM (2010)

6. Analysis of an experiment on neutron-rich isotopes
   S. Ash, M. Warren, N. Frank, G. Christian, A. Gade, A. Spyrou, M. Thoennessen, T. Baumann, G. F. Grinyer, D. Weisshaar, P. A. DeYoung
   CEU Poster EA.00005, Division of Nuclear Physics Fall Meeting, Santa Fe, NM (2010)

7. MoNA and two-neutron decay analysis
   Amanda Grovom, Alegra Aulie, Warren F. Rogers
   CEU Poster EA.00007, Division of Nuclear Physics Fall Meeting, Santa Fe, NM (2010)

CEU, 2011 DNP Fall Meeting, East Lansing, MI

1. Modeling neutron events in MoNA-LISA using MCNPX
   Margaret Kendra Elliston, Alexander Peters, Kristen Stryker, Sharon Stephenson, MoNA Collaboration
   CEU Poster EA.00039, Division of Nuclear Physics Fall Meeting, East Lansing, MI (2011)

2. Calibration of the MoNA and LISA arrays for the LISA commissioning experiment
   A. Grovom, J. Kwiatkowski, W. F. Rogers, MoNA Collaboration
   CEU Poster EA.00058, Division of Nuclear Physics Fall Meeting, East Lansing, MI (2011)

3. Calibration of the sweeper chamber charged-particle detectors for the LISA commissioning experiment
   J. Kwiatkowski, A. Grovom, W. Rogers, Westmont College, MoNA Collaboration
   CEU Poster EA.00073, Division of Nuclear Physics Fall Meeting, East Lansing, MI (2011)

4. Optical attenuation in MoNA and LISA detector elements
   Logan Rice, Jonathan Wong, MoNA Collaboration
   CEU Poster EA.00112, Division of Nuclear Physics Fall Meeting, East Lansing, MI (2011)

5. Testing and installation of a high efficiency CsI scintillator array
   Natalie Viscariello, Stuart Casarotto, Nathan Frank, Jenna Smith, Michael Thoennessen
   CEU Poster EA.00135, Division of Nuclear Physics Fall Meeting, East Lansing, MI (2011)

CEU, 2012 DNP Fall Meeting, Newport Beach, CA

1. Simulating neutron interactions in the MoNA-LISA/Sweeper setup with Geant4
   Magdalene MacArthur
   CEU Poster EA.00054, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2012)

2. Analysis of LISA commissioning run data for study of ^{24}O excited state decay energies
   N. Taylor, S. Garrett, A. Barker and W. F. Rogers
   CEU Poster EA.00060, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2012)

3. Calibration of charged-particle detectors for the LISA commissioning experiment
   S. Garrett, N. Taylor, A. Barker and W. Rogers
   CEU Poster EA.00059, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2012)

4. Active target simulation
   Nathan Smith, Peter Draznik and Nathan Frank
   CEU Poster EA.00003, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2012)

5. Exploration of three-body decay using jacobian coordinates
   Mark Hoffmann, Kyle Williams and Nathan Frank
   CEU Poster EA.00002, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2012)

6. Composition of the ^{24}O ground state wave function
   R. A. Scotten, E. Traynor, P. A. DeYoung, N. T. Islam and R. A. Haring-Kaye
   CEU Poster EA.00066, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2012)

7. Preparation for MoNA/LISA VANDLE $^{56}Ni(d,n)$ experiment at the NSCL
   Z. J. Bergstrom, R. L. Kozub W. A. Peters, J. A. Cizewski, M. E. Howard, D.W. Bardayan, R. Ikeyama S.V. Paulauskas, M. Madurga, R. Grzywacz, P. A. DeYoung, T. Baumann, J. Smith and M. Thoennessen
   CEU Poster EA.00071, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2012)

CEU, 2013 DNP Fall Meeting, Newport News, VA

1. Precise timing calibration for MoNA and LISA detectors
   Sierra Garrett , Alyson Barker , Nathaniel Taylor , Warren F. Rogers
   CEU Poster EA.00062, Division of Nuclear Physics Fall Meeting, Newport News, VA (2013)

2. Isotope separation and decay energy calculation for LISA commissioning experiment
   Nathaniel Taylor , Alyson Barker , Sierra Garrett , Warren F. Rogers
   CEU Poster EA.00063, Division of Nuclear Physics Fall Meeting, Newport Beach, CA (2013)

3. Commissioning a hodoscope detector
   Andrew Lulis, Abdul Merhi, Nathan Frank, Daniel Bazin, Jenna Smith, Michael Thoennessen
   CEU Poster EA.00072, Division of Nuclear Physics Fall Meeting, Newport News, VA, October, 2013

4. Segmented target design
   Abdul Rahman Merhi, Nathan Frank, Paul Gueye, Michael Thoennessen
   CEU Poster EA.00074, Division of Nuclear Physics Fall Meeting, Newport News, VA, October, 2013

5. Converting VANDLE data into ROOT for merging with other systems
   Z.J. Bergstrom, R.L. Kozub, W.A. Peters, R. Ikeyama, S.V. Paulauskas, S. Ahn, RIBENS-, MoNA/LISA-, VANDLE-Collaborations
   CEU Poster EA.00080, Division of Nuclear Physics Fall Meeting, Newport News, VA, October, 2013

CEU, 2014 DNP Fall Meeting, Waikoloa, HI

1. Detector calibrations for fragmentations reactions with relativistic heavy ions at the NSCL
   Heather Garland, Sharon Stephenson, Michelle Mosby
   CEU Poster GB.00042, Division of Nuclear Physics Fall Meeting, Waikoloa, HI October, 2014

2. Unbound Resonances in Light Nuclei
   Elizabeth Havens, Joseph Finck, Paul Gueye, Michael Thoennessen
   CEU Poster GB.00041, Division of Nuclear Physics Fall Meeting, Waikoloa, HI October, 2014

3. Decay energies for $^{24}O \rightarrow {}^{23}O$ + n using MoNA-LISA-Sweeper detector systems and Monte Carlo simulations
   Sierra Garrett, Alyson Barker, Rachel Parkhurst, Warren Rogers, Anthony Kuchera
   CEU Poster GB.00043, Division of Nuclear Physics Fall Meeting, Waikoloa, HI October, 2014

Regional undergraduate presentations: Talks and other posters

1. The MoNA project
   U. Onwuemene and T. Grant
   Illinois Section of the AAPT Fall Meeting, Decatur, IL, October 18–19, 2002

2. The MoNA project
   M. R. Evanger and R. E. Turner
   Minnesota Area Association of Physics Teachers Fall Meeting, Morris, MN, October 25–26, 2002

3. Calibration of organic scintillator bars for the Modular Neutron Detector Array
   J. W. Longacre
   Indiana Section of the AAPT Spring Meeting, Bloomington, IN, April 25–26, 2003

4. Neutron detection by the Modular Neutron Array (MoNA)
   D. McCollum
   Indiana Section of the AAPT Spring Meeting, Bloomington, IN, April 25–26, 2003

5. Experimental developments along the neutron dripline
   J. Robertson
   Indiana Section of the AAPT Spring Meeting, Bloomington, IN, April 25–26, 2003

6. Tracking single and multiple neutron events in the Modular Neutron Array
   A. Ratkiewicz
   Society of Physics Students, Zone 9 Fall 2005 Meeting, Marquette University, Milwaukee WI, October 13–14, 2005

7. Tracking single and multiple neutron events in the Modular Neutron Array
   A. Ratkiewicz
   Joint Meeting of the 16th Annual Argonne Symposium for Undergraduates in Science, Engineering and Mathematics & the Central States Universities, incorporated (CSUI), November 4–5, 2005

8. Tracking single and multiple neutron events in the Modular Neutron Array
   A. Ratkiewicz
   20th National Conference on Undergraduate Research, Asheville, NC, April 5–8, 2006

9. Accurate energy calibrations from cosmic ray measurements
   A. DeLine
   Posters at the Capitol, Capitol Rotunda, Lansing, Michigan, April 16, 2008

10. Observation of a resonance state in ^{25}F
    Alison R. Smith, Mark S. Kasperczyk, Nathan H. Frank
    19th Annual Argonne Symposium for Undergraduates in Science, Engineering and Mathematics, Argonne National Laboratory, Argonne, Illinois, November 7, 2008

11. Observation of a resonance state in ^{25}F
    Alison R. Smith, Mark S. Kasperczyk, Nathan H. Frank
    Spring Meeting of the Illinois Section of the AAPT, Illinois Wesleyan University, Bloomington, Illinois, April 3–4, 2009

12. Observation of a resonance state in ^{26}F
    Mark S. Kasperczyk, Alison R. Smith, Nathan H. Frank
    Spring Meeting of the Illinois Section of the AAPT, Illinois Wesleyan University, Bloomington, Illinois, April 3–4, 2009

13. Assembly and testing of the Large Area Multi-Institutional Array: LISA
    Mathieu Ndong, Samuel Stewart, and Zachary Torstrick
    Notre Dame Science and Engineering Summer Research Symposium, August 6, 2010

14. Assembly and testing of scintillation neutron detectors for LISA
    Alex R. Howe
    Ohio Five Summer Science Research Symposium, Ohio Wesleyan University, Delaware, OH, July 23, 2010

15. Assembly and testing of LISA neutron detectors
    Robert E. Anthony
    Ohio Five Summer Science Research Symposium, Ohio Wesleyan University, Delaware, OH, July 23, 2010

16. Assembly and testing of the Large Area multi-Institutional Scintillator Array (LISA)
    Zachary Torstrick, Samuel Stewart, Mathieu Ndong
    25th National Conference on Undergraduate Research, Ithaca, NY, March 31–April 2, 2011

17. Analysis of neutron-rich isotopes
    Natalie Viscariello
    Celebration of Learning, Augustana College, Rock Island, IL, May 5, 2012

18. Testing and installation of a high-efficiency CsI scintillator array
    Stuart Casarotto
    Celebration of Learning, Augustana College, Rock Island, IL, May 5, 2012

19. Active target simulation
    Nathan Smith
    2012 Quadrennial Physics Congress, Orlando, FL, Nov. 8-10, 2012

20. Testing and installation of a high efficiency CsI scintillator array
    Natalie Viscariello
    2012 Quadrennial Physics Congress, Orlando, FL, Nov. 8-10, 2012

21. Active target simulation
    Nathan Smith
    Celebration of Learning, Augustana College, Rock Island, IL, Jan. 29, 2013

22. Testing and efficiency of a high efficiency CsI scintillator array
    Natalie Viscariello
    Sigma Xi Research Presentations, Augustana College, Rock Island, IL, Jan. 29, 2013

23. Exploration of three-body decay using Jacobian coordinates
    Mark Hoffmann
    Sigma Xi Research Presentations, Augustana College, Rock Island, IL, Jan. 29, 2013

24. Exploration of three-body decay using Jacobian coordinates
    Mark Hoffmann and Kyle Williams
    Sigma Xi Research Presentations, Augustana College, Rock Island, IL, May 4, 2013

MoNA in the media

1. MoNA: The Modular Neutron Array Video
   Bryan Luther
   Centennial Scholars Program, Moorhead, MN, February 11, 2003

2. Undergraduates assemble neutron detector
   T. Feder
   Physics Today, p. 25, March 2005

3. Undergraduates as researchers
MoNA Collaboration
The Chronicle of Higher Education, Letter to the Editor, The Chronicle Review, Vol. 53 ,Issue 33, (April 20, 2007)
http://chronicle.com/subscribe/login?url=/weekly/v53/i33/33b02102.htm

4. Raising MoNA
A. Jia
Symmetry Vol. 4 p. 6 Aug. 2007
http://www.symmetrymagazine.org/cms/?pid=1000511

5. Giving students a taste of research
M. Thoennessen
Physics World, p. 16, Feb. 2008

6. Going beyond the neutron drip-line with MoNA
J. A. Brown for the MoNA Collaboration
Nuclear Physics News 20, p. 23, 2010

7. Focus: Nuclei emit paired-up neutrons
Michael Schirber
Physics 5, 30 (2012)

8. MoNA makes first confirmed sighting of dineutron decay
CERN COURIER, April 27 (2012)
cerncourier.com/cws/article/cern/49341

9. Michigan's MoNA LISA
http://nscl.msu.edu/general-public/news/2012/michigan039s-mona-lisa

10. MoNA makes first confirmed sighting of dineutron decay. CERN COURIER, April 27, 2012
http://cerncourier.com/cws/article/cern/49341

11. R&D News April 16, 2012
http://goo.gl/EWIxd1

12. Dineutron emission seen for the first time
IOP physicsworld.com, March 14, 2012 http://goo.gl/TD3RAQ

13. Unknown form of nuclear decay
Popular Science, Science and Technology Portal. May 9, 2012 http://popular-science.net/tag/dineutron
http://physicsworld.com/cws/article/news/2012/mar/14/dineutron-emission-seen-for-the-first-time

MoNA on the web

1. The MoNA homepage
http://www.cord.edu/dept/physics/mona/

2. MoNA Wikipedia article
http://en.wikipedia.org/wiki/Modular_Neutron_Array

3. MoNA YouTube video
http://www.youtube.com/watch?v=qPlsFu5m41s

4. MoNA on Facebook
http://www.facebook.com/pages/Modular-Neutron-Array/143503835659905

5. Research.gov insights into nuclear decay
http://goo.gl/hQw3O8

Publications in refereed journals

1. Using passive converters to enhance detection efficiency of 100-MeV neutrons
   T. Baumann, H. Ikeda, M. Kurokawa, M. Miura, T. Nakamura, Y. Nishi, S. Nishimura, A. Ozawa, T. Sugimoto, I. Tanihata, and M. Thoennessen
   Nucl. Instr. And Meth. A 505, 25 (2003)

2. MONA—The Modular Neutron Array
   B. Luther, T. Baumann, M. Thoennessen, J. Brown, P. DeYoung, J. Finck, J. Hinnefeld, R. Howes, K. Kemper, P. Pancella, G. Peaslee, W. Rogers and S. Tabor
   Nucl. Instr. And Meth. A 505, 33 (2003)

3. Fabrication of a modular neutron array: A collaborative approach to undergraduate research
   R. H. Howes, T. Baumann, M. Thoennessen, J. Brown, P. A. DeYoung, J. Finck, J. Hinnefeld, K. W. Kemper, B. Luther, P. V. Pancella, G. F. Peaslee, W. F. Rogers, and S. Tabor
   American Journal of Physics 73, 122 (2005)

4. Construction of a Modular Large-Area Neutron Detector for the NSCL
   T. Baumann, J. Boike*, J. Brown, M. Bullinger*, J. P. Bychoswki*, S. Clark*, K. Daum*, P. A. DeYoung, J. V. Evans*, J. Finck, N. Frank, A. Grant*, J. Hinnefeld, G. W. Hitt, R. H. Howes, B. Isselhardt*, K. W. Kemper, J. Longacre*, Y. Lu*, B. Luther, S. T. Marley*, D. McCollum*, E. McDonald*, U. Onwuemene*, P. V. Pancella, G. F. Peaslee, W. A. Peters, M. Rajabali*, J. Robertson*, W. F. Rogers, S. L. Tabor, M. Thoennessen, E. Tryggestad, R. E. Turner*, P. J. VanWylen*, N. Walker*
   Nucl. Instr. And Meth. A 543, 517 (2005)

5. Selective population and neutron decay of an excited state of ^{23}O
   A. Schiller, N. Frank, T. Baumann, D. Bazin, B. A. Brown, J. Brown, P. A. DeYoung, J. E. Finck, A. Gade, J. Hinnefeld, R. Howes, J.-L. Lecouey, B. Luther, W. A. Peters, H. Scheit, M. Thoennessen, J. A. Tostevin
   Phys. Rev. Lett. 99 112501 (2007)

6. Production of nuclei in neutron unbound states via primary fragmentation of ^{48}Ca
   G. Christian, W. A. Peters, D. Absalon*, D. Albertson*, T. Baumann, D. Bazin, E. Breitbach*, J. Brown, P. L. Cole*, D. Denby*, P. A. DeYoung, J. E. Finck, N. Frank, A. Fritsch*, C. Hall*, A. M. Hayes*, J. Hinnefeld, C. R. Hoffman, R. Howes, B. Luther, E. Mosby*, S. Mosby*, D. Padilla*, P. V. Pancella, G. Peaslee, W. F. Rogers, A. Schiller, M. J. Strongman, M. Thoennessen, L. O. Wagner*
   Nucl. Phys. A801, 101 (2008)

7. Big physics at small places: The Mongol horde model of undergraduate research
   P. J. Voss*, J. E. Finck, R. Howes, J. Brown, T. Baumann, A. Schiller, M. Thoennessen, P. A. DeYoung, G. Peaslee, J. Hinnefeld, B. Luther, P. V. Pancella, W. F. Rogers
   Journal of College Teaching and Learning 5(2), 37 (2008)

8. Determination of the N = 16 shell closure at the oxygen drip line
   C. R. Hoffman, T. Baumann, D. Bazin, J. Brown, G. Christian, P. A. DeYoung, J. E. Finck, N. Frank, J. Hinnefeld, R. Howes, P. Mears*, E. Mosby*, S. Mosby*, J. Reith*, B. Rizzo*, W. F. Rogers, G. Peaslee, W. A. Peters, A. Schiller, M. J. Scott*, S. L. Tabor, M. Thoennessen, P. J. Voss*, and T. Williams* (MoNA Collaboration)
   Phys. Rev. Lett. 100, 152502 (2008)

9. Ground state energy and width of ^{7}He from ^{8}Li proton knockout
   D. H. Denby*, P. A. DeYoung, T. Baumann, D. Bazin, E. Breitbach*, J. Brown, N. Frank, A. Gade, C. C. Hall*, J. Hinnefeld, C. R. Hoffman, R. Howes, R. A. Jenson*, B. Luther, S. M. Mosby*, C. W. Olson*, W. A. Peters, A. Schiller, A. Spyrou, and M. Thoennessen
   Phys. Rev. C 78, 044303 (2008)

10. Neutron decay spectroscopy of neutron-rich oxygen isotopes
    N. Frank, T. Baumann, D. Bazin, B. A. Brown, J. Brown, P. A. DeYoung, J. E. Finck, A. Gade, J. Hinnefeld, R. Howes, J.-L. Lecouey, B. Luther, W. A. Peters, H. Scheit, A. Schiller, M. Thoennessen, and J. Tostevin
    Nucl. Phys. A813, 199 (2008)

11. Evidence for a doubly magic ^{24}O
    C. R. Hoffman, T. Baumann, D. Bazin, J. Brown, G. Christian, D. H. Denby*, P. A. DeYoung, J. E. Finck, N. Frank, J. Hinnefeld, S. Mosby*, W. A. Peters, W. F. Rogers, A. Schiller, M. J. Scott*, A. Spyrou, S. L. Tabor, M. Thoennessen, P. J. Voss*, (MoNA Collaboration)
    Phys. Lett. B 672, 17 (2009)

*undergraduate student

12. Disappearance of the N = 14 shell
    M. J. Strongman, A. Spyrou, C. R. Hoffman, T. Baumann, D. Bazin, J. Brown, P. A. DeYoung, J. E. Finck, N. Frank, S. Mosby, W. F. Rogers, G. F. Peaslee, W. A. Peters, A. Schiller, S. L. Tabor, and M. Thoennessen
    Phys. Rev. C 80, 021302(R) (2009)

13. First evidence for a virtual ^{18}B ground state
    A. Spyrou, T. Baumann, D. Bazin, G. Blanchon, A. Bonaccorso, E. Breitbach*, J. Brown, A. DeLine*, P. A. DeYoung, J. E. Finck, N. Frank, S. Mosby, W. A. Peters, A. Russel*, A. Schiller, M. J. Strongman, and M. Thoennessen
    Phys. Lett. B 683, 129 (2010)

14. First observation of excited states in ^{12}Li
    C. C. Hall*, E. M. Lunderberg*, P. A. DeYoung, T. Baumann, D. Bazin, G. Blanchon, A. Bonaccorso, B. A. Brown, J. Brown, G. Christian, D. H. Denby*, J. Finck, N. Frank, A. Gade, J. Hinnefeld, C. R. Hoffman, B. Luther, S. Mosby, W. A. Peters, A. Spyrou, and M. Thoennessen
    Phys. Rev. C 81, 021301(R) (2010)

15. Observation of a two-neutron cascade from a resonance in ^{24}O
    C. R. Hoffman, T. Baumann, J. Brown, P. A. DeYoung, J. E. Finck, N. Frank, J. Hinnefeld, S. Mosby, W. A. Peters, W. F. Rogers, A. Schiller, J. Snyder, A. Spyrou, S. L. Tabor, and M. Thoennessen
    Phys. Rev. C 83, 031303(R) (2011)

16. Neutron knockout of ^{12}Be populating neutron-unbound states in ^{11}Be
    W. A. Peters, T. Baumann, B. A. Brown, J. Brown, P. A. DeYoung, J. E. Finck, N. Frank, K. L. Jones, J.-L. Lecouey, B. Luther, G. F. Peaslee, W. F. Rogers, A. Schiller, M. Thoennessen, J. A. Tostevin, and K. Yoneda
    Phys. Rev. C 83, 057304 (2011)

17. Neutron unbound states in ^{25,26}F
    N. Frank, D. Albertson*, J. Bailey*, T. Baumann, D. Bazin, B. A. Brown, J. Brown, P. A. DeYoung, J. E. Finck, A. Gade, J. Hinnefeld, R. Howes, M. Kasperczyk*, B. Luther, W. A. Peters, A. Schiller, A. Smith*, M. Thoennessen, and J. A. Tostevin
    Phys. Rev. C 84, 037302 (2011).

18. Search for the ^{15}Be ground state
    A. Spyrou, J. K. Smith, T. Baumann, B. A. Brown, J. Brown, G. Christian, P. A. DeYoung, N. Frank, S. Mosby, W. A. Peters, M. J. Strongman, M. Thoennessen, and J. A. Tostevin
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19. Nuclear structure at and beyond the neutron drip line
    T. Baumann, A. Spyrou, and M. Thoennessen
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20. First observation of ground state dineutron decay: ^{16}Be
    A. Spyrou, Z. Kohley, T. Baumann, D. Bazin, B. A. Brown, G. Christian, P. A. DeYoung, J. E. Finck, N. Frank, E. Lunderberg*, S. Mosby, W. A. Peters, A. Schiller, J. K. Smith, J. Snyder, M. J. Strongman, M. Thoennessen, and A. Volya
    Phys. Rev. Lett. 108, 102501 (2012)

21. Evidence for the ground-state resonance of ^{26}O
    E. Lunderberg*, P. A. DeYoung, Z. Kohley, H. Attanayake, T. Baumann, D. Bazin, G. Christian, D. Divaratne, S. M. Grimes, A. Haagsma*, J. E. Finck, N. Frank, B. Luther, S. Mosby, T. Nagi*, G. F. Peaslee, A. Schiller, J. Snyder, A. Spyrou, M. J. Strongman, and M. Thoennessen
    Phys. Rev. Lett. 108, 142503 (2012)

22. Exploring the low-Z shore of the island of inversion at $N = 19$
    G. Christian, N. Frank, S. Ash*, T. Baumann, D. Bazin, J. Brown, P. A. DeYoung, J. E. Finck, A. Gade, G. F. Grinyer, A. Grovom*, J. D. Hinnefeld, E. M. Lunderberg*, B. Luther, M. Mosby, S. Mosby, T. Nagi*, G. F. Peaslee, W. F. Rogers, J. K. Smith, J. Snyder, A. Spyrou, M. J. Strongman, M. Thoennessen, M. Warren*, D. Weisshaar, and A. Wersal*
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23. Modeling interactions of intermediate-energy neutrons in a plastic scintillator array with GEANT4
    Z. Kohley, E. Lunderberg*, P. A. DeYoung, B. T. Roeder, T. Baumann, G. Christian, S. Mosby, J. K. Smith, J. Snyder, A. Spyrou, M. Thoennessen
    Nuclear Instruments and Methods in Physics Research Section A 682, 59–65 (2012)

24. Spectroscopy of neutron-unbound ^{27,28}F
    G. Christian, N. Frank, S. Ash*, T. Baumann, P. A. DeYoung, J. E. Finck, A. Gade, G. F. Grinyer, B. Luther, M. Mosby, S. Mosby, J. K. Smith, J. Snyder, A. Spyrou, M. J. Strongman, M. Thoennessen, M. Warren*, D. Weisshaar, and A. Wersal*
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25. Reply to "Comment on: 'Neutron knockout of ^{12}Be populating neutron-unbound states in ^{11}Be' "
W. A. Peters, T. Baumann, B. A. Brown, J. Brown, P. A. DeYoung, J. E. Finck, N. Frank, K. L. Jones, J.-L. Lecouey, B. Luther, G. F. Peaslee, W. F. Rogers, M. Thoennessen, and J. A. Tostevin
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A. Spyrou, Z. Kohley, T. Baumann, D. Bazin, B.A. Brown, G. Christian, P.A. DeYoung, J.E. Finck, N. Frank, E. Lunderberg*, S. Mosby, W.A. Peters, A. Schiller, J.K. Smith, J. Snyder, M.J. Strongman, M. Thoennessen, and A. Volya
Phys. Rev. Lett. 109, 239202 (2012)

27. Unresolved question of the ^{10}He ground state resonance
Z. Kohley, J. Snyder, T. Baumann, G. Christian, P. A. DeYoung, J. E. Finck, R. A. Haring-Kaye, M. Jones, E. Lunderberg*, B. Luther, S. Mosby, A. Simon, J. K. Smith, A. Spyrou, S. L. Stephenson, and M. Thoennessen,
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28. Neutron unbound states in ^{28}Ne and ^{25}F
J. K. Smith, T. Baumann, B. A. Brown, G. Christian, J. E. Finck, C.R. Hoffman, Z. Kohley, S. Mosby, J. F. Novak*, S. J. Quinn*, J. Snyder, A. Spyrou, M. J. Strongman, and M. Thoennessen (MoNA Collaboration)
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29. First observation of ^{13}Li ground state
Z. Kohley, E. Lunderberg*, P. A. DeYoung, A. Volya, T. Baumann, G. Christian, A. Gade, C. Hall*, S. Mosby, J. K. Smith, J. Snyder, A. Spyrou, M. Thoennessen
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30. Study of two-neutron radioactivity in the decay of ^{26}O
Z. Kohley, T. Baumann, D. Bazin, G. Christian, P. A. DeYoung, J. E. Finck, N. Frank, M. Jones, E. Lunderberg*, S. Mosby, T. Nagi*, J. K. Smith, J. Snyder, A. Spyrou, M. Thoennessen,
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31. Observation of a low-lying neutron-unbound state in ^{19}C
M. Thoennessen, S. Mosby, N. S. Badger*, T. Baumann, D. Bazin, M. Bennett*, J. Brown, G. Christian, P. A. DeYoung, J. E. Finck, M. Gardner*, E. A. Hook*, B. Luther, D. A. Meyer, M. Mosby, W. F. Rogers, J. K. Smith, A. Spyrou, and M. J. Strongman
Nucl. Phys. A912, 1 (2013)

32. Novel techniques to search for one- and two-neutron radioactivity
M. Thoennessen, G. Christian, Z. Kohley, T. Baumann, M. Jones, J. K. Smith, J. Snyder, A. Spyrou,
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J. Snyder, T. Baumann, G. Christian, R. A. Haring-Kaye, P. A. DeYoung, Z. Kohley, B. Luther, M. Mosby, S. Mosby, A. Simon, J. K. Smith, A. Spyrou, S. Stephenson, and M. Thoennessen,
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34. Exploiting neutron-rich radioactive ion beams to constrain the symmetry energy
Z. Kohley, G. Christian, T. Baumann, P. A. DeYoung, J. E. Finck, N. Frank, M. Jones, J. K. Smith, J. Snyder, A. Spyrou, and M. Thoennessen,
Phys. Rev. C88, 041601 (2013)

35. Search for ^{21}C and constraints on ^{22}C
S. Mosby, N.S. Badger*, T. Baumann, D. Bazin, M. Bennett*, J. Brown, G. Christian, P.A. DeYoung, J.E. Finck, M. Gardner*, J.D. Hinnefeld, E.A. Hook*, E.M. Lunderberg*, B. Luther, D.A. Meyer, M. Mosby, G.F. Peaslee, W.F. Rogers, J.K. Smith, J. Snyder, A. Spyrou, M.J. Strongman, and M. Thoennessen,
Nucl. Phys. A900, 69 (2013)

36. Determining the ^{7}Li(n,γ) cross section via Coulomb dissociation of ^{8}Li
R. Izsak, A. Horvath, A. Kiss, Z. Seres, A. Galonsky, C. A. Bertulani, Zs. Fulop, T. Baumann, D. Bazin, K. Ieki, C. Bordeanu, N. Carlin, M. Csanad, F. Deak, P. DeYoung, N. Frank, T. Fukuchi, A. Gade, D. Galaviz, C. R. Hoffman, W. A. Peters, H. Schelin, M. Thoennessen, and G. I. Veres,
Phys. Rev. C 88, 065808 (2013)

37. Low-lying neutron unbound states in ^{12}Be
J.K. Smith, T. Baumann, D. Bazin, J. Brown, S. Casarotto*, P.A. DeYoung, N. Frank, J. Hinnefeld, M. Hoffman*, M.D. Jones, Z. Kohley, B. Luther, B. Marks*, N. Smith*, J. Snyder, A. Spyrou, S.L. Stephenson, M. Thoennessen, N. Viscariello*, and S.J. Williams,
Phys. Rev. **C 90**, 024309, (2014)

38. Selective population of unbound states in ^{10}Li
J.K. Smith, T. Baumann, J. Brown, P. A. DeYoung, N. Frank, J. Hinnefeld, Z. Kohley, B. Luther, B. Marks*, A. Spyrou, S. L. Stephenson, M. Thoennessen, and S. J. Williams,
Nucl. Phys. **A940**, 235 (2015)

39. Search for unbound ^{15}Be states in the $3n$+^{12}Be channel
A. N. Kuchera, A. Spyrou, J. K. Smith, T. Baumann, G. Christian, P. A. DeYoung, J. E. Finck, N. Frank M. D. Jones, Z. Kohley, S. Mosby, W. A. Peters, and M. Thoennessen,
Phys. Rev. **C 91**, 017304 (2015)

40. Three-body correlations in the ground-state decay of ^{26}O
Z. Kohley, T. Baumann, G. Christian, P. A. DeYoung, J. E. Finck, N. Frank, B. Luther, E. Lunderberg, M. Jones, S. Mosby, J. K. Smith, A. Spyrou, and M. Thoennessen,
Phys. Rev. **C 91**, 034323 (2015)

41. Further insights into the reaction ^{14}Be(CH_2,X)^{10}He
M.D. Jones, Z. Kohley, T. Baumann, G. Christian, P.A. DeYoung, J.E. Finck, N. Frank, R.A. Haring-Kaye, A.N. Kuchera, B. Luther, S. Mosby, J.K. Smith, J. Snyder, A. Spyrou, S.L. Stephenson, and M. Thoennessen,
Phys. Rev. **C 91**, 044312 (2015)

42. Population of ^{13}Be in nucleon exchange reactions
B. R. Marks*, P. A. DeYoung, J. K. Smith, T. Baumann, J. Brown, N. Frank, J. Hinnefeld, M. Hoffman, M. D. Jones, Z. Kohley, A. N. Kuchera, B. Luther, A. Spyrou, S. Stephenson, C. Sullivan, M. Thoennessen, N. Viscariello, and S. J. Williams,
Submitted to Phys. Rev. **C**, (2015)

43. Neutron correlations in the decay of excited ^{11}Li
J.K. Smith, T. Baumann, D. Bazin, J. Brown, P. A. DeYoung, M. D. Jones, Z. Kohley, B. Luther, B. Marks*, A. Spyrou, S. L. Stephenson, M. Thoennessen, and A. Volya,
Submitted to Phys. Lett. **B**, (2015)

44. Unbound excited states of the $N = 16$ closed-shell nucleus ^{24}O
W. F. Rogers, S. Garrett, A. Grovom, R. E. Anthony, A. Aulie, A. Barker, T. Baumann, J. J. Brett, J. Brown, G. Christian, P. A. DeYoung, J. E. Finck, N. Frank, A. Hamann, R. A. Haring-Kaye, A. R. Howe, N. T. Islam, M. D. Jones, A. N. Kuchera, J. Kwiatkowski, E. M. Lunderberg, B. Luther, D. A. Meyer, S. Mosby, A. Palmisano, R. Parkhurst, A. Peters, J. Smith, J. Snyder, A. Spyrou, S. L. Stephenson, M. Strongman, B. Sutherland, N. E. Taylor, and M. Thoennessen,
Submitted to Phys. Rev. **C**, (2015)

Conference proceedings

1. MONA: The Modular Neutron Array at the NSCL
T. Baumann, J. A. Brown, P. DeYoung, J. E. Finck, J. D. Hinnefeld, R. Howes, K. W. Kemper, B. A. Luther, P. V. Pancella, G. F. Peaslee, W. F. Rogers, S. L. Tabor, and M. Thoennessen
Proceedings of the 17$^{\text{th}}$ International Conference on the Application of Accelerators in Research and Industry CAARI 2002, AIP Conf. Proc. 680, 554 (2003)

2. First results from MoNA
A. Schiller, T. Baumann, D. Bazin, J. Brown, P. DeYoung, N. Frank, A. Gade, J. Hinnefeld, R. Howes, R. A. Kryger, J.-L. Lecouey, B. Luther, W. A. Peters, J. R. Terry, M. Thoennessen, and K. Yoneda
Proceedings of the International Conference on Frontiers in Nuclear Structure, Astrophysics, and Reactions (FINUSTAR), Kos, Greece, 12–17 September 2005; AIP Conf. Proc. 831, 92 (2006)

3. Can the neutron capture cross sections be measured with Coulomb dissociation?
Á. Horvath, K. Ieki, Á. Kiss, A. Galonsky, M. Thoennessen, T. Baumann, D. Bazin, C. A. Bertulani, C. Bordeanu, N. Carlin, M. Csanád, F. Deák, P. DeYoung, N. Frank, T. Fukuchi, Zs. Fülöp, A. Gade, D. R. Galaviz, C. Hoffman, R. Izsák, W. A. Peters, H. Schelin, A. Schiller, R. Sugo, Z. Seres, and G. I. Veres
Eur. Phys. J. A 27, s01, 217 (2006)

4. Observation of the first excited state in ^{23}O
N. Frank, A. Schiller, T. Baumann, D. Bazin, J. Brown, P. A. DeYoung, J. E. Finck, A. Gade, J. Hinnefeld, R. Howes, J.-L. Lecouey, B. Luther, W. A. Peters, H. Scheit, and M. Thoennessen
Proceedings of the 23$^{\text{rd}}$ Winter Workshop on Nuclear Dynamics, edited by W. Bauer, R. Bellwied and J. W. Harris, p. 187, EP Systema, Budapest, Hungary (2007)

5. Exploring neutron-rich oxygen isotopes with MoNA
N. Frank, T. Baumann, D. Bazin, J. Brown, P. DeYoung, J. E. Finck, A. Gade, J. Hinnefeld, R. Howes, J.-L. Lecouey, B. Luther, W. A. Peters, H. Scheit, A. Schiller, and M. Thoennessen
Proceedings of the International Conference on Proton Emitting Nuclei and Related Topics, PROCON07, edited by L. Ferreira, AIP Conference Proceedings 961, 143 (2007)

6. Population of neutron unbound states via two-proton knockout reactions
N. Frank, T. Baumann, D. Bazin, A. Gade, J.-L. Lecouey, W. A. Peters, H. Scheit, A. Schiller, M. Thoennessen, J. Brown, P. DeYoung, J. E. Finck, J. Hinnefeld, R. Howes, and B. Luther
Proceedings of the 9th International Spring Seminar on Nuclear Physics, Changing Facets of Nuclear Structure, edited by A. Covello, p. 23, World Scientific (2008)

7. Efficiency of the Modular Neutron Array (MoNA)
W. A. Peters, T. Baumann, G. A. Christian, D. Denby, P. A. DeYoung, J. E. Finck, N. Frank, C. C. Hall, J. Hinnefeld, A. Schiller, M. J. Strongman, and M. Thoennessen
Proceedings of the 22nd International Conference on the Application of Accelerators in Research and Industry CAARI 2008, AIP Conference Proceedings 1099, 807 (2009)

8. Nuclear structure physics with MoNA-LISA
S. L. Stephenson, J. A. Brown, P. A. DeYoung, J. E. Finck, N. H. Frank, J. D. Hinnefeld, R. A. Kaye, B. A. Luther, G. F. Peaslee, D. A. Meyer, W. F. Rogers and the MoNA Collaboration
Neutron Spectroscopy, Nuclear Structure, Related Topics: XIX International Seminar of Neutrons with Nuclei, (Joint Institute for Nuclear Research, Dubna, Russia, 2012) 138–144

9. Exploring the neutron dripline two neutrons at a time: The first observations of the ^{26}O and ^{16}Be ground state resonances
Z. Kohley, A. Spyrou, E. Lunderberg, P. A. DeYoung, H. Attanayake, T. Baumann, D. Bazin, B. A. Brown, G. Christian, D. Divaratne, S. M. Grimes, A. Haagsma, J. E. Finck, N. Frank, B. Luther, S. Mosby, T. Nagi, G. F. Peaslee, W. A. Peters, A. Schiller, J. K. Smith, J. Snyder, M. J. Strongman, M. Thoennessen, and A. Volya
Proceedings of the 11th International Conference on Nucleus-Nucleus Collisions (NN2012), Journal of Physics: Conference Series (JPCS) 420, 012052 (2013)

10. New measurements of the properties of neutron-rich projectile fragments
D. J. Morrissey, K. Meierbachtol, M. Mosby, M. Thoennessen, and the MoNA Collaboration
Proceedings of the 11th International Conference on Nucleus-Nucleus Collisions (NN2012), Journal of Physics: Conference Series 420, 012102 (2013)

11. Observation of ground-state two-neutron decay
M. Thoennessen, Z. Kohley, A. Spyrou, E. Lunderberg, P.A. DeYoung, H. Attanayake, T. Baumann, D. Bazin, B.A. Brown, G. Christian, D. Divaratne, S.M. Grimes, A. Haagsma, J.E. Finck, N. Frank, B. Luther, S. Mosby, T. Nagi, G.F. Peaslee, W.A. Peters, A. Schiller, J.K. Smith, J. Snyder, M. Strongman, and A. Volya,
Proceedings of the Zakopane 2012 Conference, Acta Physica Polonica B 44, 543 (2013)

12. Structure and decay correlations of two-neutron systems beyond the dripline
Z. Kohley, T. Baumann, D. Bazin, G. Christian, P. A. DeYoung, J. E. Finck, R.A. Haring-Kaye, J. Hinnefeld, N. Frank, E. Lunderberg, B. Luther, S. Mosby, W. A. Peters, J. K. Smith, J. Snyder, S.L. Stephenson, M. J. Strongman, A. Spyrou, M. Thoennessen, and A. Volya,
Proceedings of the 3rd International Workshop on State of the Art in Nuclear Cluster Physics (SOTANCP3), Journal of Physics: Conference Series 569, 012033 (2014)

13. Study of Neutron-Unbound States with MoNA
A. N. Kuchera, A. Spyrou, J. K. Smith, T. Baumann, G. Christian, P. A. DeYoung, J. E. Finck, N. Frank, M. D. Jones, Z. Kohley, S. Mosby, W. A. Peters, and M. Thoennessen
Proceedings of the International Symposium on Exotic Nuclei, EXON 2014, edited by Yu. E. Penionzhkevich and Yu. G. Sobolev, p. 625, World Scientific (2015)

MoNA experiments

Experiment	Year	Spokesperson	Title	Status
discretionary	2002		micro MoNA	
03502	2003	W. A. Peters	MoNA test run	[7]
04503	2004	N. Frank	Sweeper magnet test	[13]
03048	2004	J. Finck	Ground state wave function of ^{12}Be	[21–23]
03033	2004	J.-L. Lecouey	Is ^{24}O a doubly magic nucleus?	[13, 24–30]
03038	2005	A. Kiss	Coulomb-breakup of neutron-rich nuclei	[31, 32]
05502	2005	P. DeYoung	^{7}He breakup	[33]
05039	2005	P. DeYoung	Going beyond the $N = 16$ shell in oxygen	[34–38]
05033	2005	P. DeYoung	Population of neutron-unbound states from direct fragmentation, test	completed (see 05124)
05034	2006	A. Schiller	Two-neutron decay of ^{13}Li	[39, 40]
06504	2006	M. Thoennessen	Sweeper magnet beam blocker test	completed
05124	2006	W. A. Peters	Neutron-dripline studies with direct fragmentation	[41]
07503	2007	W. A. Peters	Measurement of MoNA's Efficiency	[21]
06025	2008	T. Baumann	Di-neutron decay of ^{16}Be	[42–47]
08016	2008	A. Spyrou	Ground State of Neutron-Unbound ^{24}N	Insufficient statistics
08026	2008	A. Schiller	Two-Neutron Decay from the ground state of ^{26}O	[48–50, 47, 46]
07039	2009	P. DeYoung	Ground-State Neutron Decay of ^{21}C	[51, 52]
09040	2010	N. Frank	Study of Neutron Unbound States in ^{28}F	[53–55]
09069	2010	M. Mosby	Excitation Energy of Neon Prefragments	[56]
09067	2010	P. DeYoung	^{15}Be Ground State Formed via a (d,p) Reaction	[57, 58]
09028	2010	A. Schiller	^{24}O Neutron Knockout to ^{23}O Excited States	analysis in progress
10023	2011	W. Rogers	Unbound States in Neutron-Rich Oxygen Isotopes	analysis in progress
10007	2012	J. Smith	Two-neutron decay of ^{11}Li	[59]
11027	2013	W. A. Peters	(d,n) studies using MoNA-LISA and VANDLE	analysis in progress
11028	2014	D. Bazin	Knockout reactions on p-shell nuclei	analysis in progress
12004	2014	N. Frank	Determination of the energy gap between the $sd - pf$ neutron shells in ^{25}O	analysis in progress
12011	2014	Z. Kohley	Exploring the Equation of State with RIBs	analysis in progress
14014	–	A. Kuchera	Understanding two-nucleon unbound systems	Approved
15091	–	P. DeYoung	Measurement of ^{9}He ground and excited states	Approved
15118	–	N. Frank	Lifetime measurements with the decay-in-target method	Approved

7 People

MoNA undergraduate students

Name	Institution	Type	Year	Status
Melanie Evanger	Concordia	all year	2001–2002	Master's from Indiana Bloomington: Senior Engineer at BAE Systems
Maria-Teresa Herd	Bryn Mawr	MSU REU	2001–2002	Assistant Professor of Physics, Earlham College
Mustafa Rajabali	Concordia	all year	2001–2002	PhD in nuclear physics from Tennessee, Assistant Professor at Tennessee Tech
Ramsey Turner	Concordia	all year	2001–2002	Master's in Engineering from UMinnesota, IT analyst at Waldorf College
Anna Volftsun	Bergen Ct. HS	summer	2001–2002	Patent Lawyer in NYC, Harvard Law
Paul Yeager	NSCL	all year	2001–2002	pursued career as opera singer
Joseph Bychowski	Hope	summer	2002–2003	Masters Degree from University of Notre Dame, Sales Engineer at Advanced Research Systems
Jim Evans	IUSB	summer	2002–2003	Engineering Manager, Mobile Climate Control, Goshen IN
Tony Grant	Millikin	summer	2002–2003	Instructor at ITT Technical Institute, Lincoln IL
Brett Isselhardt	Westmont	all year	2002–2003	Postdoc at Lawrence Livermore
Walter Kiefer	Western Michigan	all year	2002–2003	unknown
Adam Lincoln	Western Michigan	all year	2002–2003	PhD from Wayne State University, Systems Integrator - Lead at Wayne State University
James Longacre	Ball State	all year	2002–2003	Master's from Ball State, Radiation Safety Officer, Reid Hospital, Richmond IN
Yao Lu	Okemos HS	summer	2002–2003	unknown
Scott Marley	IUSB	all year	2002–2003	PhD from Western Michigan University 2012: Postdoc at Notre Dame
David McCollum	Ball State	all year	2002–2003	unknown
Eric McDonald	Central Michigan	all year	2002–2003	Software Development Engineer at Amazon
Uchenna Onwuemene	Millikin	summer	2002–2003	Masters of Civil Engineering North Carolina A&T University, CAD Operator at MACTEX Engineering
Jennifer Robertson	Ball State	all year	2002–2003	Graduate Instructor at University of Southern Mississippi
Erik Strahler	Michigan State	all year	2002–2003	Business Intelligence Developer at Epic Systems
Peter VanWylen	Hope	summer	2002–2003	Research Director at Memphis Teacher Residency
Jennifer Boike	Central Michigan	all year	2003–2004	Homemaker
Sarah Clark	Westmont	summer	2003–2004	TSA II-Library and Information Services
Kevin Daum	Central Michigan	all year	2003–2004	Application Programmer at Central Michigan University
Eric Johnson	NE Wesleyan	summer	2003–2004	PhD in nuclear physics from Florida State, Deputy Director of Life and Health Actuarial at Florida Office of Insurance Regulation
Jon Lowry	Concordia	summer	2003–2004	unknown
Nathan Walker	Westmont	all year	2003–2004	Engineer at ATK Aerospace
Lance Elliot	Westmont	all year	2004–2005	Engineer in San Diego
Draik Hecksel	Wabash	summer	2004–2005	M.S. from Purdue, Medical Physicist at Cadence Health
Utsab Khadka	Hope	all year	2004–2006	2012 PhD U of Arkansas, postdoc at Princeton University
Matt Kleber	Concordia	all year	2004–2005	Technical Engineer at Epic Systems
Patrick Mears	Hope	all year	2004–2005	Systems Integration Engineer at Abbott Laboratories

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Name	Institution	Type	Year	Status
Jason Miller	Concordia	all year	2004–2005	Master's in Engineering, U. Minnesota, Product Performance Engineer at Boston Scientific
Abe Pena	Texas	Hope REU	2004–2005	Labview Automation Consultant at Photoprotective Technologies
Robert Pepin	Gonzaga	MSU REU	2004–2005	Graduate Student at the University of Washington
Tina Pike	Hope	MSU REU	2004–2005	PhD from University Wisconsin-Madison, Medical Physicist at Affinity Health System
Justin Reith	Hope	all year	2004–2006	Graduate Student in Human Medicine at MSU University
Benjamin Rizzo	Marquette	all year	2004–2006	Graduate Student at Creighton University
Michael Strongman	Westmont	all year	2004–2005	Master's in Nuclear Physics at MSU, Air Force Technical Applications Center
Andrew Stump	Michigan State	MSU REU	2004–2005	Graduate student at University of Rochester
Phil Voss	Central Michigan	all year	2004–2006	PhD in Nuclear Physics at MSU, Visiting Assistant Professor at Concordia College
Kyle Watters	Westmont	summer	2004–2005	Professor of Physics at Creighton University
Ziqi Dai	Marquette	all year	2005–2006	Research and Development at Epic Systems
Evan Mosby	Westmont	all year	2005–2007	System Design Analyst at Esri
Shea Mosby	Westmont	all year	2005–2007	PhD in Nuclear Physics at MSU, Research Scientist at LANL
Andrew Ratkiewicz	IUSB	all year	2005–2006	PhD in Nuclear Physics at MSU, postdoc at Rutgers University
Mike Scott	Central Michigan	all year	2005–2006	Graduate student at MSU
Ted Williams	Wabash	all year	2005–2006	Graduate Student at University of Notre Dame
Daniel Absalon	Marquette	all year	2006–2007	Computer software professional in Chicago
Daniel Albertson	Concordia	MSU REU	2006–2007	U. Chicago Master's in Divinity, Global Studies Coordinator at Concordia College
Eric Breitbach	Marquette	all year	2006–2007	Graduate Student at University of Maine
Perrie Cole	Concordia	all year	2006–2007	Graduate student at University of Minnesota
Amy DeLine	Central Michigan	all year	2006–2007	Math teacher at Ben Lippen School in Columbia, SC
Deb Denby	Hope	summer	2006–2008	Homemaker
Adam Fritsch	Wabash	summer	2006–2008	Graduate student at MSU, nuclear physics
Jamie Gillette	Westmont	summer	2006–2007	unknown
Chris Hall	Hope	summer	2006–2008	Graduate student at Colorado State University
Anne Hayes	MN Morris	MSU REU	2006–2007	Technical Artist, Programmer, Water Horse Interactive
Katherine McAlpine	Michigan State	MSU REU	2006–2007	Science communicator and freelance science writer
Malinda Reese	Westmont	summer	2006–2007	Senior Administrative Assistant at Intel Corporation
Patrick O'Rourke	Wabash	summer	2006–2007	Left college
Derek Padilla	UCSD	Hope REU	2006–2007	Graduate Student at UC Santa Cruz
Lucas Wagner	Concordia	all year	2006–2007	PhD in Physics from UC Irvine, postdoc in Theoretical Physics at the Vrije Universiteit Amsterdam
Edward White	Notre Dame	MSU REU	2006–2007	unknown
Meghan Winer	Hope	summer	2006–2007	unknown
Tova Yoast-Hull	Kenyon	MSU REU	2006–2007	Graduate student in physics at University of Wisconsin

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Name	Institution	Type	Year	Status
Mike Heim	Marquette	MSU REU	2007–2008	Graduate student in physics at University of Connecticut
Robert Jensen	Concordia		2007–2008	Master's in engineering from University of Minnesota, Engineered Pump Services, Mukwonago
Chris Olsen	Concordia	all year	2007–2008	Graduate student in statistics at North Dakota State
Michael Bennett	Westmont	all year	2007–2009	Graduate student at MSU, nuclear physics
John Novak	Western Michigan	MSU REU	2008–2009	Quantitative Research Analyst Fellow at the U.S. Securities and Exchange Commission
Stephen Quinn	Notre Dame	MSU REU	2008–2009	Graduate student at MSU, nuclear physics
Elizabeth Hook	Rhodes	summer	2008–2009	Communications Specialist at American Physical Society
Rob Anthony	Ohio Wesleyan	summer	2009–2010	Graduate student in Geoscience at Colorado State University
Steven Ash	Augustana	all year	2009–2011	IT professional at the Rock Island Arsenal
Alegra Aulie	Westmont	summer	2009–2010	Junior test engineer intern, Aurrion
Nicholas Badger	Rhodes	all year	2009–2010	U.S. Navy
Hengzhi Chen	Ohio Wesleyan	summer	2009–2010	Graduate student at University of Michigan, electrical engineering
Casey DeRoo	Concordia	all year	2009–2010	Graduate student in physics at University of Iowa
Lewis Elliot	Westmont	all year	2009–2010	Project Engineer at HBE Corporation
Ben Foster	Wabash	summer	2009–2010	Graduate student in EE at Purdue
Amanda Grovom	Westmont	all year	2009–2011	Customer Service Representative at Wyatt Technology
Autumn Haagsma (Russell)	Central Michigan	all year	2009–2011	Research Scientist at Battelle Memorial Institute
Alex Howe	Ohio Wesleyan	summer	2009–2010	Graduate student at Princeton, astrophysics
Megan Jacobsen	Concordia	all year	2009–2010	Graduate student in medical physics at University of Houston
Philip Kasavan	Westmont	all year	2009–2010	Graduate student at Cal Poly San Luis Obispo
Steve Kuhn	Earlham	OWU REU	2009–2010	Graduate student at Notre Dame, physics
Matthew Miller	Rhodes	all year	2009–2010	unknown
Tim Nagi	Hope	all year	2009–2010	Research and Development at Gentex
Sam Novario	Notre Dame	MSU REU	2009–2010	Graduate student at MSU, nuclear physics
Mathieu Ndong	IUSB	summer	2009–2010	Graduate student in petroleum engineering at University of Oklahoma
Alexander Peters	Gettysburg	all year	2009–2011	Graduate student in computer engineering at Columbia University
Kimberly Purtell	Central Michigan	summer	2009–2010	Math and science high school teacher
Kaitlynne Rethman	Central Michigan	all year	2009–2011	Peace Corps
Logan Rice	Wabash	summer	2009–2010	Teaching English in China
Sam Stewart	IUSB	summer	2009–2010	Technical writer at Whirlpool
Zach Torstrick	IUSB	summer	2009–2010	Software engineer at IU Bloomington
Brad Vest	Wabash	summer	2009–2010	IT professional in Indianapolis
Mark Warren	Augustana	all year	2009–2011	Graduate student at Illinois Institute of Technology
Alissa Wersal	Montana	MSU REU	2009–2010	ZEMAX Analyst at Radiant ZEMAX, LLC
Dan Barofsky	Central Michigan	all year	2010–2011	Graduate student at Central Michigan University
Stuart Casarotto	Augustana	all year	2010–2012	Class of 2014
Kendra Elliston	Gettysburg	summer	2010–2011	Class of 2014
Taimur Islam	Ohio Wesleyan	summer	2010–2013	Graudate student in physics at Duke University

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Name	Institution	Type	Year	Status
Eric Lunderberg	Hope	all year	2008–2011	Graduate Student in nuclear physics at MSU
James McGugan	Colorado College	OWU REU	2010–2011	Graduate student at Columbia, applied physics
Katelyn Montgomery	Central Michigan	all year	2010–2011	Delphius Medical Technologies, Detroit
Meredith Sargent	Idaho	MSU REU	2010–2011	Math major at University of Idaho
Chris Simmons	IUSB	MSU REU	2010–2011	Submarine Warfare Officer, US Navy
Kristen Stryker	Gettysburg	all year	2010–2011	Graduate student in medical physics at Columbia University
Rachael Tomasino	Central Michigan	all year	2010–2011	Graduate student in astronomy at University of Denver
Caitlin Taylor	Hope	all year	2010–2011	Graduate student at University of Tennessee
Eric Traynor	Hope	all year	2010–2013	Graduate student in economics
Natalie Viscariello	Augustana	all year	2010–2012	Graduate student in medical physics at Wisconsin
Jonathan Wong	Wabash	summer	2010–2012	Graduate student in enginnering at Columbia
Magdalene McArthur	Howard University	summer	2011-2012	Ed. intern at Howard Univ. Middle School for Math. and Science
Peter Draznik	Augustana	all year	2011–2012	Graduate student in applied math at MSU
Mark Hoffman	Augustana	all year	2011–2012	Graduate student in analytics at NCSU
Ben Pigg	Ohio Wesleyan	all year	2011–2012	Graduate student in engineering at Washington Univ. St. Louis
Richard Scotten	Fullerton College / Ohio Wesleyan	OWU REU	2011–2012	Web designer, LA
Nathan Smith	Augustana	all year	2011–2012	Graduate student in applied physics at Northern Arizona Univ.
Kyle Williams	Augustana	all year	2011–2012	Pre-sales engineer at Insight Enterprise
Alicia Palmisano	Gettysburg	all year	2011–2014	Graduate student in physics at MSU
David Thompson	Gettysburg	all year	2012–2014	Graduate student in engineering, Carnegie Mellon
Kevin Krautbauer	Concordia	summer	2011–2012	Direct Service Professional at Care for Reaching Independence
Sierra Garrett	Westmont College	all year	2012–2013	Assoc. lab director, Westmont College
Alyson Barker	Westmont College	all year	2012–2013	Class of 2015
Nathaniel Taylor	Westmont College	all year	2012–2013	Class of 2015
Bethany Sutherland	Westmont College	all year	2011–2012	Engineering Administrator, Santa Barbara Imaging Systems
Jackson Kwiatkowski	Westmont College	all year	2011–2012	Project Manager at Rapid Product Solutions
Abdul Merhi	Augustana	all year	2012–2013	Graduate student in engineering at Iowa State
Franz Utermohlen	Gettysburg College	summer	2013–2014	Graduate student, nuclear theory, Ohio State
Andrew Lulis	Augustana	all year	2012–2013	physics major, Ohio State (transfer)
Zach Ingbretson	Concordia	all year	2012–2013	Class of 2014
Glenn Patterson	Wabash	summer	2012–2013	Class of 2014
Jaclyn Brett	Hope College	summer	2012-	Class of 2016
Braden Marks	Hope College	summer	2012-	Class of 2016
Mark Klehfoth	IUSB	summer	2010–2011	Graduate student in physics at University of Chicago
Caleb Bancroft	Central Michigan	all year	2013–	Vineyard worker, northern Michigan
Richard Adam Bryce	Central Michigan	all year	2014–	Graduate student at Central Michigan University
Joseph Bullaro	Augustana	summer	2014–	Class of 2015
Heather Garland	Gettysburg	summer	2014–	Class of 2017
Rachel Parkhurst	Westmont College	summer	2014–	Class of 2016
David Hicks	Central Michigan	all year	2013–2014	Graduate student in computational physics at Duke University
Eli McDonald	Augustana	summer	2014–	applied biology, Vanderbilt (transfer)
Andy Dong	Wabash College	summer	2014-15	Class of 2017
Inbum Lee	Wabash College	summer	2014-15	Class of 2016
Elizabeth Havens	Central Michigan	all year	2014âĂŞ	Class of 2016
Sam Wilensky	Gettysburg College	summer	2015âĂŞ	Class of 2017

MoNA graduate students

Name	Affiliation	Start	Graduated	Experiment	Project/Title of Thesis
Nathan Frank	MSU	2000	2006	03033	Spectroscopy of neutron unbound states in neutron rich oxygen isotopes
William Peters	MSU	1999	2007	03048	Commissioning and first results from MoNA
Calem Hoffman	FSU	2004	2009	05039	Investigation of the neutron-rich oxygen isotopes at the dripline
Greg Christian	MSU	2006	2008 (M.S.)	05124	Production of unbound nuclei via fragmentation
		2009	2011	09040	Spectroscopy of neutron unbound fluorine
Michael Strongman	MSU	2006	2011 (M.S.)	08016	Neutron spectroscopy of ^{22}N and the disappearance of the N = 14 shell
Shea Mosby	MSU	2007	2011	07039	Spectroscopy of neutron unbound states in neutron rich carbon
Jesse Snyder	MSU	2008	2013	09067	^{15}Be via (d,p)
Jenna Smith	MSU	2009	2014	10007	Two-neutron decay of ^{11}Li
Michael Jones	MSU	2011		12004	^{24}O (d,p)
Krysten Stiefel	MSU	2012		12011	Constraining symmetry energy

Other graduate students

Name	Affiliation	Start	Graduated	Experiment	Project/Title of Thesis
Michelle Mosby	MSU	2007	2014	09069	Excitation energy of neon prefragments
Harsha Attanayake	OU	2008		08026	Two-neutron decay from the ground state of ^{26}O
Dilupama Divaratne	OU	2008	2014	09028	^{24}O neutron knockout to ^{23}O excited states
Rudy Izsak	Budapest	2005	2013	03038	Coulomb-breakup of neutron-rich nuclei
Jessica Freeman	Hampton	2013			Segmented target
Adeleke Adeyemi	Hampton	2014			

MoNA Post-Doctoral Researchers

Name	Dates	Current Position
Jean-Luc Lecouey	2003-2005	Staff Physicist, LPC Caen, France
Ken Yoneda	2003-2005	Research Scientist, RIKEN, Japan
Andreas Schiller	2003-2007	Research Scientist Norwegian Defense Research Establishment, Oslo, Norway
Heiko Scheit	2006	Research Scientist GSI, Germany
Artemis Spyrou	2007-2009	Assistant Professor Michigan State University, East Lansing, MI
Zachery Kohley	2011-2012	Assistant Professor Michigan State University, East Lansing, MI
Anthony Kuchera	2014-	
Aditya Wakhle	2014	

MoNA collaboration directors

Year	Name	Institution
2001–2002	Bryan A. Luther	Concordia College
2002–2003	Thomas Baumann	Michigan State University
2003–2004	Joseph E. Finck	Central Michigan University
2004–2005	Paul A. DeYoung	Hope College
2005–2006	James A. Brown	Wabash College
2006–2007	Jerry D. Hinnefeld	Indiana University at South Bend
2007–2008	Warren F. Rogers	Westmont College
2008–2009	Paul A. DeYoung	Hope College
2009–2010	Bryan A. Luther	Concordia College
2010–2011	Deseree Meyer	Rhodes College
2011–2012	Nathan Frank	Augustana College
2012–2013	Robert Haring-Kaye	Ohio Wesleyan University
2013–2014	Sharon Stephenson	Gettysburg College
2014–2015	Warren Rogers	Westmont College
2015–2016	James A. Brown	Wabash College

Awards

1. Michael Thoennessen: 2005 APS Division of Nuclear Physics Fellow.
2. Calem Hoffman: 2010 APS Dissertation Award in Nuclear Physics.
3. Paul DeYoung: 2012 APS Forum on Education Fellow.
4. Michael Thoennessen: 2012 DNP Mentoring Award.
5. Kaitlynne Rethman: one of the inaugural "10 under 10" awards from CMU. www.e-digitaleditions.com/i/320292, 2014.

Faculty grants

1. RUI: Radioactive nuclear beam physics with undergraduates at Hope College
   Paul A. DeYoung and Graham F. Peaslee
   NSF 0098061, 06/01/2001–05/31/2005
2. MRI: Construction of one layer of a highly efficient neutron detector to study neutron-rich rare isotopes at the NSCL (Hope College)
   Paul A. DeYoung and Graham F. Peaslee
   NSF 0132405, 09/01/2001–12/31/2004
3. MRI: Construction of one layer of a highly efficient neutron detector to study neutron-rich rare isotopes at the NSCL
   Joseph Finck
   NSF 0132532, 09/01/2001–08/31/2004
4. MRI: High efficency neutron detector layer
   James Brown
   NSF 0132507, 0432042, 09/01/2001–08/31/2004
5. MRI: Construction of a Layer of a Highly Efficient Neutron Detection Wall for NSCL (IUSB)
   Jerry Hinnefeld
   NSF 0132567, 09/01/2001–08/31/2004
6. MRI: Fabrication of One Layer of a High-Efficiency Neutron Detector
   Ruth Howes
   NSF 0132367, 09/01/2001–08/31/2004
7. MRI: Constructing a Layer for the Large Neutron Detector at NSCL
   Paul Pancella
   NSF 0132438, 09/01/2001–08/31/2004

8. MRI: A Highly Efficient Neutron Detector Array to Study Neutron-Rich Rare Isotopes at the NSCL
   Bryan Luther
   NSF 0132725, 09/01/2001–08/31/2004

9. MRI: Large high-efficiency neutron array detector at MSU
   Warren Rogers
   NSF 0132641, 09/01/2001–08/31/2003

10. RUI: Multifaceted opportunities in nuclear physics for undergraduates at Hope College
    Paul A. DeYoung and Graham F. Peaslee
    NSF 0354920, 05/15/2004–04/30/2008

11. Nuclear physics research at Westmont College
    Warren Rogers
    NSF 0502010, 06/01/2005–05/31/2010

12. An RUI proposal to investigate the neutron drip line using the Modular Neutron Array
    Joseph Finck
    NSF 0555439, 07/15/2006–06/30/2009

13. RUI: Using MoNA, exploring neutron unbound states in nuclei near and beyond the neutron dripline
    James Brown
    NSF 0555488, 07/01/2006–06/30/2010

14. RUI: Fundamental and applied nuclear physics with undergraduates
    Paul A. DeYoung and Graham F. Peaslee
    NSF 0651627, 05/15/2007–04/30/2011

15. RUI: Studying exotic nuclei with the Modular Neutron Array (MoNA)
    Joseph Finck
    NSF 0855456, 9/01/2009–08/31/2012

16. MRI-Consortium: Development of a neutron detector array by undergraduate research students for studies of exotic nuclei
    Bryan Luther NSF 0922559, 10/01/2009–09/30/2012

17. MRI-Consortium: Development of a neutron detector array by undergraduate research students for studies of exotic nuclei
    Robert Kaye
    NSF 0922409, 10/01/2009–09/30/2012

18. MRI-Consortium: Development of a neutron detector array by undergraduate research students for studies of exotic nuclei
    Deseree Meyer
    NSF 0922473, 10/01/2009–09/30/2012

19. MRI-Consortium: Development of a neutron detector array by undergraduate research students for studies of exotic nuclei
    Sharon Stephenson
    NSF 0922335, 10/01/2009–09/30/2012

20. MRI-Consortium: Development of a neutron detector array by undergraduate research students for studies of exotic nuclei
    James Brown
    NSF 0922446, 10/01/2009–09/30/2012

21. MRI-Consortium: Development of a neutron detector array by undergraduate research students for studies of exotic nuclei
    Jerry Hinnefeld
    NSF 0922537, 10/01/2009–09/30/2012

22. MRI-Consortium: Development of a neutron detector array by undergraduate research students for studies of exotic nuclei
    Joseph Finck
    NSF 0922462, 10/01/2009–09/30/2012

23. MRI-Consortium: Development of a neutron detector array by undergraduate research students for studies of exotic nuclei
    Warren Rogers
    NSF 0922622, 10/01/2009–09/30/2012

24. MRI-Consortium: Development of a neutron detector array by undergraduate research students for studies of exotic nuclei
    Paul A. DeYoung and Graham F. Peaslee
    NSF 0922794, 10/01/2009–09/30/2012

25. RUI: Studies of unstable neutron-rich nuclei and interdisciplinary applications of nuclear physics with undergraduates
    Paul A. DeYoung
    NSF 0969058, 05/15/2010–04/30/2013

26. RUI: Establishing an Undergraduate Research Group in Nuclear Physics
    Nathan Frank
    NSF 0969173, 09/15/2010–08/31/2014

27. RUI: Study of light exotic nuclei near the neutron dripline
    Warren Rogers
    NSF 1101745, 05/15/2011–05/14/2014

28. RUI: Studies of exotic nuclei with the MoNA LISA neutron detectors
    Joseph Finck
    NSF 1205357, 06/01/2012–05/31/2016

29. RUI: Neutron physics from ^{4}He to the edge of the dripline
    Sharon Stephenson
    NSF 1205537, 10/1/2012–09/30/2015

30. RUI: Cutting-Edge Nuclear Physics Research (Collaborative and Interdisciplinary) at Hope College
    Paul A. DeYoung
    NSF 1306074, 06/15/2013–05/31/2016

31. Active target development for the study of neutron-unbound nuclei
    P. Gueye, M. Thoennessen, and N. Frank
    NSSC-MSI Research Grant Award, NNSA, 1/1/2013- 12/31/2015

32. RUI: Undergraduate Research on Neutron-Rich Nuclei
    Nathan Frank
    NSF 1404236, 08/1/2014–07/31/2017

33. RUI: Study of Exotic Neutron-Rich Nuclei at Westmont College and NSCL,MSU
    Warren Rogers
    NSF 1506402, 07/15/2015–07/14/2018

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