

Spring 2017

dimensions

Department of Physics & Astronomy

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Northwestern University

On the cover:

Credit: **Zachary Hafen** (Faucher-Giguère)

This collection of images shows gas swirling around the same galaxy simulation in several different ways. Each row shows changes as the galaxy evolves over eight billion years. Each column shows the same moment from different perspectives. The top row shows the density of gas at a given time: in each panel, the brightest areas show where gas is most densely concentrated. The middle row measures the radial velocity of the gas: gas shoots out of the galaxy in the bright areas and plummets toward the center of galaxy in the darkest areas. The bottom row shows temperature: the brighter the area, the hotter the gas. Taken together, these snapshots create a time-lapse projection. Models like these help astrophysicists understand the chaotic, explosive, ever-changing lives of evolving galaxies.

Faculty News

In January 2017, **Eric Dahl** was one of 102 recipients of the **PECASE** (Presidential Early Career Awards for Scientists and Engineers) award, the highest honor bestowed by the United States government to early career scientists. The department congratulates Eric on this achievement.

NASA's Jet Propulsion Laboratory featured the work of **Raffaella Margutti** in a press release on the significance of supernova SN 2014C, a "chameleon supernova." Prof. Margutti commented that "This 'chameleon supernova' may represent a new mechanism of how massive stars deliver elements created in their cores to the rest of the universe."

Mel Ulmer is leading a project to unfurl the world's largest space telescope. <https://research.northwestern.edu/news/mission-impossible-ulmer-leading-audacious-project-unfurl-world%E2%80%99s-largest-space-telescope>

Prem Kumar, AT&T Professor of Information Technology (joint with Electrical Engineering) served as Program Manager for the Defense Science Office, Defense Advanced Research Projects Agency, Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics from February 2013 to February 2017. He received the Secretary of Defense Medal for Outstanding Public Service. His citation noted his "pioneering contributions to quantum and optical sciences, enabling new capabilities that directly benefitted the Department of Defense and other areas of the United States Government."

Giles Novak joined the ALMA Science Advisory Committee http://ciera.northwestern.edu/news/news_2016-2017.php#NovakALMA



Faculty News (continued)

Vicky Kalogera won the Walder Award for Research Excellence <https://news.northwestern.edu/stories/2017/may/vicky-kalogera-walder-research-award/>

The **London Prize** is the premier prize in the field of low-temperature physics. It is awarded every 2 or 3 years, and previous winners include Lev Landau, John Bardeen, William Fairbank, Brian Josephson, David Thouless, Wolfgang Ketterle, and in 2014 to Michel Devoret, John Martinis, and Rob Schoelkopf. **Bill Halperin** and **Jim Sauls** share the prize with Jeevak Parpia (Cornell). To date, 12 winners of the London Prize also have the Nobel Prize in Physics. They are cited by the committee for their pioneering work on the influence of disorder on the superfluidity of Helium.

John Ketterson published the book “The Physics of Solids”. This comprehensive text covers the basic physics of the solid state starting at an elementary level suitable for undergraduates but then advancing, in stages, to a graduate and advanced graduate level. In addition to treating the fundamental elastic, electrical, thermal, magnetic, structural, electronic, transport, optical, mechanical and compositional properties, we also discuss topics like superfluidity and superconductivity along with special topics such as strongly correlated systems, high-temperature superconductors, the quantum Hall effects, and graphene. Particular emphasis is given to so-called first principles calculations utilizing modern density functional theory which for many systems now allow accurate calculations of the electronic, magnetic, and thermal properties.

Northwestern University astrophysicist **Claude-André Faucher-Giguère**, an expert in galaxy formation, has received a Faculty Early Career Development Program (CAREER) award from the National Science Foundation (NSF). The foundation’s most prestigious honor for junior faculty members supports both research and education initiatives. In addition, Professor Faucher-Giguère authored a chapter on insights from galaxy formation simulations in the book “Gas Accretion onto Galaxies” published by Springer in early 2017.

Special Thanks to our Donors

The Department of Physics and Astronomy would like to sincerely thank all of our donors who contribute greatly to our mission.

Our Department currently has 32 graduate faculty and 12 faculty at other ranks (instructional and research faculty). Our graduate program generally has about 99 graduate students and 27 full-time Postdoctoral Research Fellows associated with it, along with a varying number of Visiting Scholars and other distinguished guests. In most years, we have about 60 undergraduate majors in our department, many of them working in our research programs.

The Center for Fundamental Physics at Low Energy (CFP)

The Center for Fundamental Physics at Low Energy (CFP for short) is a long-term initiative of the Northwestern Department of Physics and Astronomy. The faculty members, graduate students and undergraduates associated with the CFP, along with CFP fellows, specialize in small-scale, low-energy experiments to investigate the particles, interactions, and symmetries of the universe - to test and help develop our most fundamental theoretical descriptions. A weekly CFP colloquium features the most exciting international developments in relevant atomic, molecular, and optical physics, along with related developments in high energy physics, astrophysics, and new detector technologies. Associates of the CFP, researchers from Northwestern and neighboring institutions who broaden the CFP community by their participation in the CFP colloquium, help select colloquium topics and speakers. The CFP also encourages interdisciplinary activities that reflect upon, illuminate and reveal the assumptions, implications and methods of fundamental physics.

Northwestern University is an eager and ideal host for this unique center of excellence. As part of its active engagement in increasing the stature and visibility of the Department of Physics and Astronomy, and in improving the intellectual opportunities for its students and faculty, Northwestern is launching the CFP with new faculty lines for a founding director and core research group leaders. The university is providing freshly renovated, adjacent laboratories in the Mudd building, and a suite of offices in the heart of the Department of Physics and Astronomy. The university is also committed to providing the crucial support services that CFP researchers (and many others at the university) need to fabricate intricate apparatus for cutting-edge laboratory measurements. Included are maintaining a well-equipped and staffed professional machine shop, a student machine shop within which students are mentored as they safely use up-to-date machine tools, an electronics design shop whose engineer is able to design electronics for precise measurements, and pursuing a sustainable and affordable source of liquid helium.

Core Research Groups in the CFP:

Board of Trustees Professor Gerald Gabrielse, one of the world's leading practitioners of fundamental, low energy physics and an active member of the National Academy of Sciences, is relocating from Harvard to Northwestern to be the founding director of the CFP. An award-winning researcher and teacher, Gabrielse has chaired both the Harvard Physics Department and the Division of Atomic, Molecular and Optical Physics (DAMOP) of the American Physical Society, and he leads the international ATRAP Collaboration at CERN. The Gabrielse research group tested the most precise prediction of the Standard Model of Particle Physics using the most precisely measured property of an elementary particle, tested the Standard Model's most fundamental symmetry to an exquisite precision, made one of the most stringent tests of Supersymmetry and other proposed improvements to the Standard Model, and started low energy antiproton and antihydrogen physics.



Associate Professor Brian Odom is joining the CFP. His fundamental physics accomplishments include a Harvard measurement of the electron magnetic moment (for which he received the DAMOP PhD thesis prize), and dark matter research done while a Kavli postdoctoral fellow at the University of Chicago. The Odom research group at Northwestern is successfully developing methods to trap, cool and probe molecular ions. One motivation is to use these for fundamental physics measurements, including new searches for time variations of some of the fundamental constants of nature.



The CFP will hire two new faculty members to lead additional core research groups of the CFP.

Selected Publications and Invited Lectures

Oleksii Shevtsov presented at the International Conference on Quantum Fluids and Solids, Prague, Czech Republic, August 6-14, 2016. ``*Electron Bubbles and Weyl Fermions in Chiral Superfluid $^3\text{He-A}$* ''

J. A. Sauls was the Invited Lecturer of the Topological Materials Program, Osaka University, Osaka, Japan

Invited Lectures: Anomalous Hall Effect in Chiral Superfluids at:

Nagoya University, November 16, 2016.

Osaka University, November 7, 2016

Kyoto University, November 4, 2016.

Invited Talk: Spontaneous Symmetry Breaking & Topological Order in Superfluid Helium, Keio University, TMS Intensive-Interactive Meeting, Nov. 17-18, 2016.

“Electron bubbles and Weyl Fermions in chiral superfluid $^3\text{He-A}$ ”, Physical Review B 94, 064511 (2016) **Oleksii Shevtsov** and **J. A. Sauls** [<https://journals.aps.org/prb/abstract/10.1103/PhysRevB.94.064511>]

“On Nambu's Fermion-Boson Mass Relations for Superfluid ^3He ”, Physical Review B (accepted and in production) [arXiv:<https://arxiv.org/abs/1611.07273>], **J. A. Sauls** and **Takeshi Mizushima** (collaborator and former visiting scholar in Professor Saul's group)

F. Yusef-Zadeh et al. [ALMA and VLA observations: Evidence for ongoing low-mass star formation near Sgr A*](#). arXiv:1701.05939. Published online January 20, 2017.

Incoherence-Mediated Remote Synchronization, Liyue Zhang, **Adilson E. Motter**, and **Takashi Nishikawa**, Phys. Rev. Lett. **118**, 174102 (2017)

Invited Physics Viewpoint Article on the Discovery of ``Half-Quantum Vortices in Topological Superfluid ^3He by S. Autti et al (PRL 117, 255301 (2016)”, **J. A. Sauls** [Physics 9, 148 (2016)] [doi: <http://dx.doi.org/10.1103/Physics.9.148>].

“Ejection of the Massive Hydrogen-rich Envelope Timed with the Collapse of the Stripped SN 2014C” **Raffaella Margutti** et al.

The Astrophysical Journal, Volume 835, Number 2 (2017)[<http://iopscience.iop.org/article/10.3847/1538-4357/835/2/140>]

Dearborn Observatory

Visiting Schedule

Spring/Summer Hours

(April-September)

9-10 pm: One hour session by reservation only. Your group will be able to use the telescope for the full hour.

10-11 pm: Walk-ins are welcome, but space in the dome is limited.

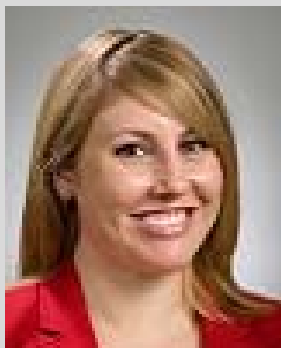
There is no charge for these Friday night tours;

however, we do require a refundable deposit for groups of 10 or more. Additionally, the Observatory is available for private viewing events on other evenings. Reservations may be requested online at <http://www.physics.northwestern.edu/about/dearborn-observatory/>. For more information, please contact Yas Shemirani at 847-491-7650.

Staff News

In December of 2016, Marsha Coffey retired from Northwestern University. Agnes Engstrom was promoted to Business Administrator shortly thereafter.

In February 2017, Katie Curth joined the department to replace Agnes as the Research Administrator.



Katie Curth
Research Administrator

Katie has been with Northwestern University for 5 years, starting as a Program Assistant in the Department of Chemistry and most recently worked as the Associate Research Administrator for the Center for Sleep and Circadian Biology for the past 4 years, where her research administration experience was focused on post-award management for the center's NASA, ONR and DARPA projects. Her favorite grant, thus far, to have worked on was the NASA Twins Year in Space study. She has a Bachelor's in English from the University of Iowa, with a concentration in Creative Writing.

Katie lives with her husband and French Bulldog puppy Winston in the Roscoe Village neighborhood of Chicago, and enjoys reading, writing, and going for long walks through different parts of the city.

Faculty Recruiting News

Over the past several years, our department has focused on growing our faculty ranks by recruiting the best and the brightest individuals to join us.

This Fall, the Center for Fundamental Physics will open. The center director, Professor Gerald Gabrielse, joins us from Harvard University. The center expects to hire two new faculty, in addition to two support staff. Moreover, the Seely Mudd Library is currently being expanded to host state-of-the-art laser laboratories. These laboratories will allow for greater independent controls that will enhance faculty research.

In addition to these two new faculty lines, we held three other searches for astrophysics, condensed matter and complex systems. All three were successful. Please join us in welcoming the following new faculty:

Astronomy & Astrophysics

Sasha Tchekhovskoy, PhD (theoretical astrophysics)

Wen-fai Fong, PhD (astronomy)

Biological Physics & Complex Systems

Michelle Driscoll, PhD

Condensed Matter

Pallab Goswami, PhD

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Research Staff and Graduate Student Achievements

Michael Zevin (Kalogera) had a paper published for the Gravity Spy project <http://iopscience.iop.org/article/10.1088/1361-6382/aa5cea?fromSearchPage=true>, and can be freely accessed at <https://arxiv.org/pdf/1611.04596.pdf>

Zachary Hafen (Faucher-Giguere) led a week-long series of workshops for Junior High Students at the Museum of Science and Industry in early May.

Katie Breivik (Larson) received 1 of 4 graduate student Honorable Mentions (out of 62 total entrants) in the Chambliss Astronomy Achievement Award Student Prize competition for graduate students at the 229th Meeting of the American Astronomical Society.

Dan Baxter was part of the PICO team that recently reported new results from the operation of the PICO-60 dark matter detector. More information can be found at <https://arxiv.org/abs/1702.07666>

Postdoctoral alumna **Laura Fissel** presented a plenary talk at 229th meeting of the American Astronomical Society http://ciera.northwestern.edu/news/news_2016-2017.php#LauraAAS229

Graduate student **Joseph Cordero Mercado (Odom)** has received an NSF Graduate Research Fellowship Program award for his proposal titled "Controlled Chemistry with Single-Particle Resolution in a Hybrid Trap."

Robert Regan (Sauls) has received the WCAS teaching award for graduate students. This award recognizes excellent teaching throughout all departments and programs of the College.

Congratulations to Class of 2017 Physics and Astronomy Majors!

Lauren Barmore
Scott Daniel Beck
Rebecca Diesing
Jessie Duncan
Ellie Flaum
Jared Paul Gupta
Evan House
Charles Kimball
Daniel Kinch
Seth Krantzler
Yao Li
Avery Miller
Leah Perri
Samuel Stuart Piehl
Jessica Rainbolt
Jessica Redensek
Liam Sunde
Tiffany Teng
Eugene Wu
Fan Xiao

Congratulations to the Newly Elected Officers for SPS!

President: Ava Polzin

Secretary: Suzanna De Peri

Programming Chair: Josh Pritz

Publicity Chair: Josemanuel Hernandez

Historian: Mihir Swaroop

Congratulations to our Undergraduate Awardees

2016-2017 Outstanding Thesis

Rebecca Diesing and Charles Kimball

2016-2017 Outstanding Junior

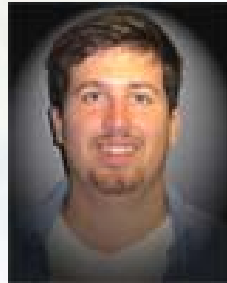
Benjamin Moy

Congratulations to our PhD and MSc Graduates



Jeffrey Berryman (De Gouvea)

Neutrino Masses and Fermion Flavor



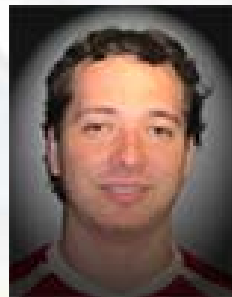
Samuel Hadden (Lithwick)

Characterizing Kepler's Multiplanet Systems with Transit Timing Variations



Miaoqi Chu (Dutta)

X-ray reactivity study of ionic liquids at electrified surfaces



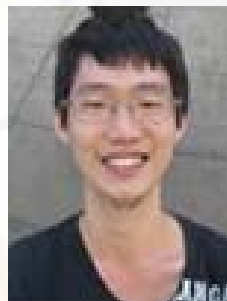
Matthew Rickert (Yusef-Zadeh)

Searching for New Sites of Recent Star Formation Towards the Central Molecular Zone: Interferometric Surveys of Water and Methanol Masers



Aprajita Hajela (Kalogera)

Understanding compact object formation and natal kicks in galactic X-ray binary systems



Hung Tan (Ulmer)



Hao Wu (Sauls)

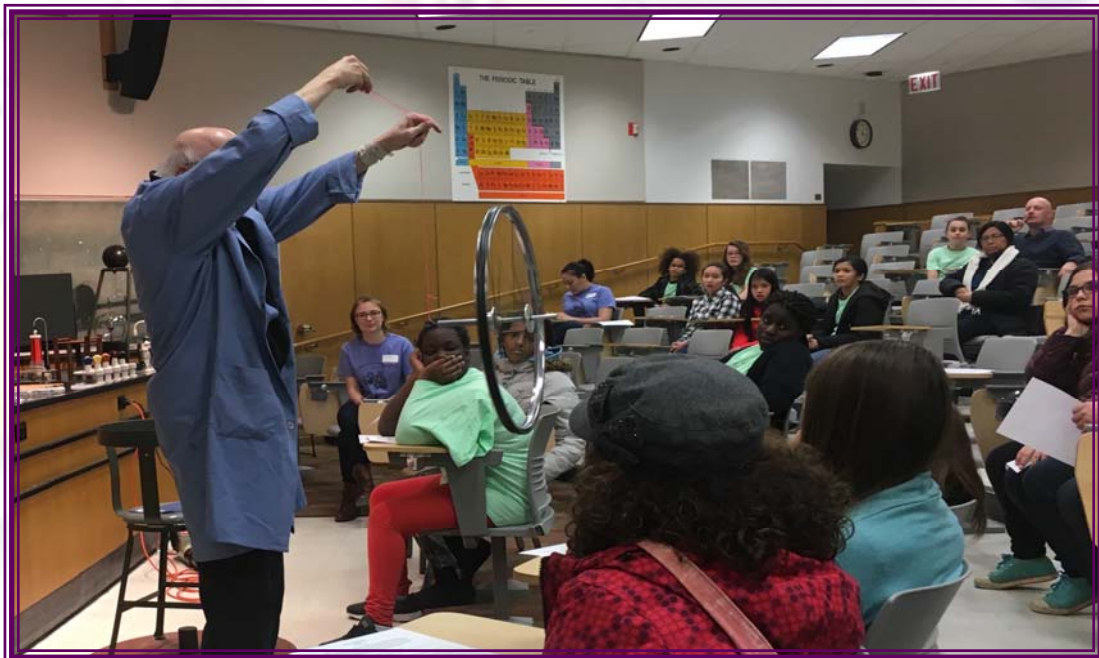
Theoretical investigation for signatures of topological superfluids and chiral superconductors

Noteworthy Events

SWE 2017 (Society of Women Engineers)

SWE is an organization that focuses on providing an outlet for Northwestern's women engineers to meet their peers, help get young women interested in math and science, and network with members of the workforce.

The Department of Physics and Astronomy is proud to be a participant in SWE activities. Professor Art Schmidt is seen below providing demonstrations for the participants.



Department Events and News

Graduate Student Recruiting and Open House 2017

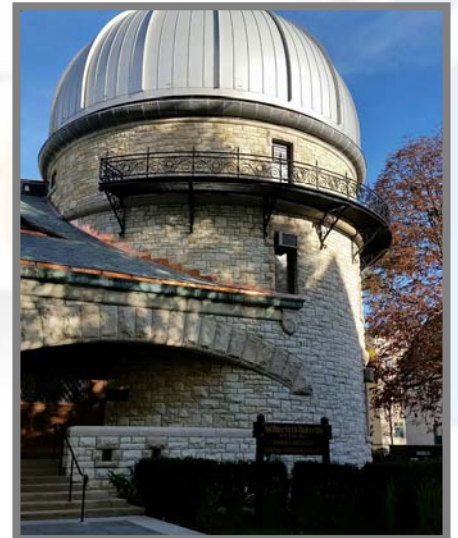
This year the department had over 370 applicants for our PhD programs. This is a significant increase over previous years and demonstrates the commitment from Weinberg College to invest in our program. In addition, our relatively new MS program is doing incredibly well and each year we receive more interest from students.

Our graduate student open house was the largest in the history of the department. We had 20 students visit our department and participate in various events that we planned.

CIERA Pilot Program Exposed Students to Astronomy Research

Science, technology, engineering, and mathematics (STEM) are crucial to innovation, yet many challenges exist to producing highly qualified STEM graduates. CIERA Professor Dave Meyer and graduate student Cody Dirks implemented a pilot of a new program called “Engaging Introductory Astronomy Students in Authentic Research through Citizen Science” through a National Science Foundation (NSF) initiative called Improving Undergraduate Science Education (IUSE). This NSF-IUSE supported pilot curriculum project created at CIERA encourages development in undergraduate STEM education through experiential teaching, innovative metrics of learning, and undergraduate research. In addition to Northwestern, the project is being pilot-tested at Oakton Community College, the University of St. Thomas, and the University of Pittsburgh for comparison. A key element is encouraging student participation in scientific processes. With the help of the Adler Planetarium, Meyer and Dirks implemented the IUSE pilot in Meyer’s Astronomy 120 course, Highlights of Astronomy, this past fall. In place of a traditional final paper in which students assess the validity of a news article reporting on an astronomical discovery, students designed and presented a scientific project from a set of data.

http://ciera.northwestern.edu/news/news_2016-2017.php#IUSE



Astrophotonics in the Department of Physics and Astronomy: Processing Stellar Light at the Microscale

Prof. Nathaniel Stern has recently joined an international collaboration with scientists at both the Australian Astronomical Observatory (AAO) and Argonne National Laboratory (ANL) to design and to fabricate photonic circuits as filters for infrared astronomical spectroscopy. The sensitivity of ground-based infrared telescopes is hindered by emission from OH molecules in the upper atmosphere. This emission creates a dense series of narrow lines polluting optical observations from space. Although this problem can be entirely removed by using space-based telescopes, the cost and resource limitations of these instruments are prohibitive. The team of AAO, ANL, and now NU plan to use advanced cleanroom processing methods to design silicon-based photonic circuits to act as tunable, precise filters to remove this background and improve the signal-to-noise of infrared spectroscopy.



The principle for this optical filtering is an old one: using a periodic optical waveguide, in this case a silicon ring of only about a micron in radius, leads to an optical resonance that can block transmission in a narrow wavelength range while leaving other spectral regions unaffected. This is the same principle Stern uses to confine light to small volumes to enhance interactions with matter, the basis of his research program manipulating coherent light-matter interactions in nanoscale materials and devices. Ring resonators are now commonplace in optical filtering and biomolecule detection because of their precision and capability for controlled tuning; the AAO/ANL/NU collaboration plans to harness these features for transformative astrophotonics.

This collaboration started with the Stern Group in an advising role, lending valuable cleanroom experience and advice from Guohua Wei (Applied Physics), Stern's first student at Northwestern. Driven by recent successes and the growing need for more sophisticated fabrication and design, this project has now blossomed into a formal collaboration between AAO, ANL, and Northwestern. Joining Stern's group this year is Pufan Liu, a new student from Materials Science and Engineering, who works with the Argonne team led by Steve Kuhlmann to realize and to improve these astrophotonic filters.

An overview of this work can be read in the February issue of the AAO Observer, available at <https://www.aao.gov.au/files/201702---Issue-131---February-2017.pdf>.

Faculty Spotlight: Professor Eric Dahl

Prof. Eric Dahl and his group build particle detectors for the direct detection of dark matter. Cosmological and astrophysical observations, ranging in scale from single galaxies to the entire visible universe, all tell us that there is 5x more “dark matter” than ordinary matter in the universe, yet thus far we have not been able to observe individual dark matter particles. We know very little about the particle nature of dark matter, only that it is massive, stable, not made of baryons (protons or neutrons), and at most weakly interacting. This is enough to exclude every type of particle we’ve encountered so far, but hypothetical particles known as WIMPs (Weakly Interacting Massive Particles) are a likely candidate for the dark matter.

PhD, Princeton, 2009



Direct detection experiments seek to observe WIMPs from our own galaxy’s dark matter halo as they scatter off of normal matter in detectors here on earth. Professor Dahl's group is part of the PICO collaboration (<http://www.picoexperiment.com>), one of several collaborations racing to unambiguously identify this signal. PICO uses bubble chambers deployed 6800 feet underground at [SNOLAB](#) to look for the ~10-keV nuclear recoils that are the signature of a WIMP interaction. Such an interaction in a PICO bubble chamber will nucleate a single bubble in the superheated fluid target. By tuning the degree of superheat, the chambers can be made completely insensitive to recoiling electrons from beta-decays and gamma-interactions -- backgrounds that plague other WIMP detection experiments. The PICO bubble chambers also employ ultrasonic acoustic detectors to distinguish nuclear recoils from alpha-decays, and high-resolution, high-speed cameras that resolve multi-bubble events from neutrons, giving the PICO experiment world-leading discrimination capability against all “typical” backgrounds to the WIMP signal.

The PICO-2L experiment (3-kg C3F8 target) has produced the most stringent limits to date from a direct detection experiment on the spin-dependent WIMP-proton cross-section. A larger detector, PICO60, has also produced competitive limits with a 30-kg CF3I target, and both detectors will begin their second physics runs at SNOLAB in 2015. The Dahl group at Northwestern leads the test-chamber program in the PICO collaboration, working with groups at Drexel, Queen’s University, and the University of Montreal to understand the exotic backgrounds that currently limit the reach of the PICO detectors.

The Dahl group is also a member of the LZ collaboration. The LZ experiment is a 7-ton xenon time projection chamber to be deployed in the Homestake Mine in South Dakota in 2019, and is the flagship US direct detection experiment for the next generation dark matter searches. The Dahl group also works on novel detector R&D, including a hybrid PICO+LZ detector based on superheated xenon.

Physics and Astronomy in the Community

North Branch Restoration Project (NBRP) at Somme Prairie Nature Preserve

A handful of the students, acquaintances and staff members of the Physics and Astronomy Graduate Student Council took part in the North Branch Restoration Project (NBRP) at Somme Prairie Nature Preserve in Northbrook, Illinois. Most of the students spent their time clearing invasive plants from the area while others gathered seeds from native plants. Those seeds were sorted by other volunteers a few weeks later and will become part of the effort to restore the prairie's natural habitat. The leaders of the NBRP taught the students about invasive species and why restoration is important. It was a much-needed break and a beautiful sunny day.



Alumni Focus

Michael Steinitz (*PhD, '70*) is now retired and a professor emeritus after 43 years of teaching and research at St. Francis Xavier University in Antigonish, Nova Scotia, Canada. Dr. Steinitz received his PhD in Materials Science in 1970 for work done in the lab of Prof. Jules Marcus. Dr. Steinitz is a past president of the Canadian Association of Physicists and past chair of the board of directors of the Canadian Institute for Photonic Innovation (a \$13 million Network of Centres of Excellence set up by the Natural Sciences and Engineering Research Council of Canada (NSERC) involving 26 universities). He is the editor in chief of the Canadian Journal of Physics for 11 years and is still active in that role.

Bryan Brown (*WCAS '70*) received his BA with distinction in Physics and later completed his PhD in Astronomy at the University of Maryland, College Park, in 1976 with his dissertation in celestial mechanics on the long period behavior of the Galilean Satellites of Jupiter. Dr. Brown spent 25 years at Goddard Space Flight Center in Greenbelt, MD, doing various things having to do with the orbits of artificial satellites, such as software development/maintenance for GSFC orbit determination systems, real time mission support for many NASA missions, both manned (STS) and unmanned (TDRS, TOPEX, EOS/TERRA, etc.), enhanced mathematical modeling for GSFC orbit determination systems. Dr. Brown has spent the last 16 years at the US Naval Research Laboratory in Washington, DC.

Krishnaswamy Raghunathan (*PhD '78*) graduated from Northwestern and was first employed by a computer company in Maryland where he was assigned to work on a project with NOAA satellite service. After about 2.5 years there he joined INTELSAT which was at that time an International Organization. Although initially he was in the ground systems (Tracking, Telemetry and Command) he eventually became part of the Space segment dealing with geosynchronous satellites in production, test and launch. After a brief time working at Space Systems/LORAL in Palo Alto, he rejoined Intelsat in 2000 and eventually became Director of Spacecraft Program Office from which he retired in 2006. Since then he has been deeply involved in writing a book on fundamentals of Electrodynamics.

Robert Hutchison (*PhD '69*) became fascinated with space exploration and astronomy during the first years of Project Blue Book (UFOs), and was inspired by films like "Destination Moon" and books about cosmology. He pursued this dream through his education, earning his Ph.D. in Astronomy from Northwestern University. He was part of the infrared astronomy program at Jet Propulsion Laboratory, performing observations at the McDonald Observatory 107-inch telescope. He was Space Scientist at Martin Marietta, Denver, where he was involved in the Viking Lander and other space science projects. He later performed nuclear magnetic resonance research at the University of Colorado Health Sciences Center, and rounded out his career as a technical writer and novelist. In addition to his lifelong interest in space science and technology, his interest today includes paleo-anthropology and climate science. He wants to understand the evolutionary nature of the human animal, and the climate that will dominate its future.



Lawrence Jones (*WCAS '48*) received his B.S. at Northwestern in 1948 and his M.S. in 1949; both degrees in physics. He attended Berkeley and received his Ph.D. in physics in 1952. Professor Jones was hired as faculty at the University of Michigan, where he has remained, though retired from teaching. He goes to his office daily, and is still involved in physics. In July he will attend a biennial International Cosmic Ray Conference in Busan, South Korea, and in June he will attend the Fermilab Annual Users Meeting when the lab celebrates its 50th anniversary.

Leonard Wojcik (*WCAS '75*) attended Cornell University where he received his MS in physics. He was hired at MITRE where he continues to work. After a few years, he attended Carnegie-Mellon University where he studied game theory and space policy and received his PhD in Engineering and Public Policy. He worked over a year for the U.S. Congress at the now extinct Office of Technology Assessment and for about two years at the Flight Safety Foundation. At MITRE, Dr. Wojcik does analytic work pertaining mainly to the U.S. aviation system, where he studies the perplexing issue of accommodating large increases in relatively new types of aviation such as drones in commercial space. Dr. Wojcik credits his undergraduate mentors for preparing him so well for his later degrees and he still applies what he learned 40 years ago while at Northwestern

Daniel Shulman (*WCAS '96*) published his first book, "Insights Hurt: Bringing Healing Thoughts to Life" in November 2015. His second book, "Personal Midrash: Fresh Insights into the Torah" will be released on August 15, 2017. He has won numerous awards and is honored with great distinction as one of the country's top in-house intellectual property attorneys from the Law Bulletin, First Chair Organization and Managing IP.

Alumni Focus (continued)

Vilmos Zsolnay (WCAS '16) will be starting in the Graduate Program in biophysical sciences at the University of Chicago in the Fall.

Bruce Harmon (PhD '73) started his career as a postdoctoral fellow at the Ames Laboratory and recently retired from Iowa State University as a Distinguished Emeritus Professor.

Bob Altizer (MS '71) enjoyed several years of employment with Motorola where, among many other successes, he designed embedded software for commercial and classified communications systems. Later, he earned his project management certification and began a career as a systems engineer for his firm BASYS Consulting. Bob sang with the Arizona Opera chorus for 20 years, appearing in over 50 productions. He is the President and CEO of Phoenix-based Musica Nova, Inc., a independent professional symphony orchestra in Arizona.



Ann Dinger Dickinson (PhD '71) taught astronomy at the University of Wisconsin—Eau Claire, Wellesley College and Williams College. She and her husband currently reside in Menlo Park, California. After leaving the university setting, Ann worked at NASA's Ames Research Center for 29 years before retiring in 2012. While not a civil servant, she was a contractor employed by Informatics, Sterling Software and Orbital Sciences Corporation. At Ames she helped design several infrared telescopes for the Space Projects Division, including Spitzer, Gemini, Kepler, and SOFIA.

Name: _____

Degree: _____

Graduation Year: _____

E-mail Address: _____

Phone Number: _____

News: _____

The department newsletter is a means of reaching out to the alumni to keep them abreast of current research and developments in the Department of Physics and Astronomy. It is also a forum for alumni to keep the department informed of their accomplishments; the department welcomes submissions from alumni of newsworthy items for publication in the newsletter. Please feel free to send in items using this form (just fold and staple the page), or to email your news to

Yas Shemirani at yassaman.shemirani@northwestern.edu



Please take the time to join our [LinkedIn](#) page for our alumni.

Follow us on [Facebook!](#)



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