

# PHYSICS AT WABASH



## Welcome!

We're back with a new edition of our newsletter, the annual review of what has happened during the past year in the Physics Department for our alumni and friends. While our teaching was pretty much back to normal, we had to pare back many of our extracurricular activities due to COVID. We were finally able to bring back Cookies at 4:00 after spring break. We're cautiously optimistic we'll be fully back this coming year.

You can keep current on what is going on through our Facebook page. Finally, please let us know what you are doing so that we can include it in next year's newsletter.

## Faculty Update



**Jim Brown** is looking forward to a sabbatical leave during the Fall semester. The MoNA collaboration continues to be active and is preparing for two approved experiments at the Facility for Rare Isotope Beams (FRIB). Jim was pleased to attend the ribbon-cutting for this new facility and see many old colleagues from the cyclotron

lab, and the collaboration had one publication,

- "Mirror nucleon removal reactions in p-shell nuclei," A. N. Kuchera *et al.* **105**, 034314 (2022).

Jim has been considering the use of Graphical Processing Units (GPUs) in fast signal processing. Technology is driving nuclear physics data acquisition systems from analog signal filtering followed by digitization to direct waveform capture. He plans to make this a focus of his sabbatical work.

Jim was happy to teach the sophomore sequence (PHY 209/210) this year and was very pleased with the enthusiasm of those students. Wabash continues to attract students with interest and drive. He worked to bring some computer modeling and computation using Python into the course, as our students continue to be interested in computing, but generally have not had much exposure to programming.

We had a great class of majors this year and Jim is very happy to see all their plans. You should read on to find out more! Jim was sad to miss graduation this year, but he was happy to visit Washington again for his daughter's graduate graduation that same weekend.

Finally, Jim is delighted to hand off department chair's duties to Dennis Krause.



**Jill Keller** continues to be the Academic Administrative Coordinator for the Physics Department. She was happy that Wabash was almost back to normal this past year. Jill brought in Subway box lunches for our yearly "cookout." Hopefully Dennis will be back on the grill this fall. Jill also helped with

our speakers on campus and the journal club. We had an end-of-year senior breakfast with math and computer science and Jill ordered coffee and donuts for everyone to enjoy. Over the summer Jill again enjoyed time with her family, by going on a history trip to Gettysburg and Philadelphia and swimming in her pool. She can't wait until the fall semester to meet the new freshman who plan to major in physics.



**Dennis Krause** was glad that we were (almost) back to normal this past year. Although masks were required most of the year, he was otherwise able to teach his classes as usual. This was especially true for the introductory calculus-based physics course (PHY 111/112). In those classes he introduced several new lab experiments

and continued the pandemic-instigated practice of col-

lecting and grading all assignments and lab work electronically.

During the fall semester, Dennis taught a freshman tutorial for the first time since 2012: "It's About Time: An Exploration of Our Modern Understanding of Time." He and his students had fun studying the physics of time (special and general relativity, the arrow of time, time in cosmology, time travel) as well as how humans perceive time. Then, in the spring, Dennis taught a special topics course, "Introduction to Quantum Information and Computing." He had always wanted to teach this, so he was happy the students, who voted on possible course topics, chose it. However, it was a learning experience for both students and the professor. This was the first course Dennis has taught in which he would have failed his own final exam had he taken it at the beginning of the semester!

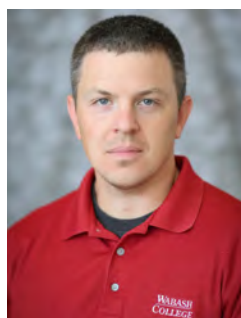
Dennis's research over the past year covered a variety of different topics. First, he co-authored a paper with colleagues at Purdue on the Eötvös test of the equivalence principle,

- "Some recent developments in 5th force searches," E. Fischbach, D. E. Krause, M. H. McDuffie, and M. J. Muetterthies, in *2021 Gravitation: Proceedings of the 55th Rencontres de Moriond*, edited by E. Augé, J. Dumarchez, and J. Trân Thanh Vân (ARISF, 2021), 29–32.

He then finished and submitted a paper on a magnetic 5th force that included significant work done by Joseph Bertaux ('19), who is now a physics graduate student at Purdue. He is also preparing to submit a paper that includes Quan Le Thien ('18) as a co-author that investigates some interesting consequences of the new lower bound on the neutrino mass published by the KATRIN collaboration earlier this year. (Dennis gave a colloquium on this work during the spring semester.)

Dennis had a research intern this summer, Nikolai Jones ('24). Together, they investigated the consequences of a quantum unstable particle being in the classically forbidden region of a potential. They ended up focusing their attention on the "barely bound" state of a particle in a 1-dimensional square well which can have a probability of being in the forbidden region that is arbitrarily close to unity. As a consequence, when they apply the unstable particle formalism developed by Dennis and Zach Rohrbach ('12), they find that the quantum unstable particle decays more rapidly than the comparable classical particle with the same energy in the same well.

Finally, Dennis is taking over department chair duties from Jim Brown.



**Matt Roark** says this past year has been a mix of old and new. While there are lessons learned that will carry forward, classes and labs returned to old norms. He also returned to his old favorite backpacking destination (Red River Gorge) for a winter trip.

During the summer Matt explored new horizons by building a DIY, open-source 3D printer (shown below). The summer project used over 800 parts and around 45 electrical connectors of varying complexity. He applied some old skills to new ideas in addition to learning something entirely new: 3D parametric computer-aided design. Thus far, some of the successfully printed designs include 3D printer modifications, an automated fish feeder, a filter for small aquariums, and self-watering planters.



**Gaylon Ross** is entering his fifth year at Wabash, serving as Visiting Associate Professor in the departments of Physics and Chemistry. The 2021-22 academic year began with Gaylon moving back to Goodrich Hall after spending two years among the chemists in Hays. He continued teaching PHY-101

Astronomy, with his labs on solar system models and stellar parallax measurements taking place on the mall and serving as advertisements for the course. He taught FRC-101 Enduring Questions for the second time, and again enjoyed leading one of the two liberal arts courses required of all freshmen. Because of this, he requested to teach FRT-101 Freshman Tutorial in the fall semester



of 2022, choosing the topic “Power for the People: Energy Resources in a Changing World.” The course will explore how energy has been utilized throughout human history, where we are now, and our options for sustainable energy sources in the future. With such hot-button issues as global climate change, recent gas and oil price spikes, supply chain concerns, and general anti-nuclear sentiment, it should be a class filled with lively discussions. Gaylon has already started working with the students who will be taking the course, as he is serving as their academic advisor for the upcoming year. He plans to be very overt in his efforts to turn several of these freshmen into physics majors.

The 2022 graduating seniors in physics were the first cohort that Gaylon had gotten to know as freshmen. He taught most of them in several courses, including PHY-111L Physics I Lab, PHY-314 Electromagnetic Theory and PHY-315 Quantum Mechanics, and felt that a number of these students should be recognized for their high achievement in physics and active participation in the department. With the support of the physics faculty, he corresponded with the national office of Sigma Pi Sigma, the physics honor society, and on April 27, 2022, the local chapter inducted five new members at a banquet in Trippet Hall, the first ceremony held at Wabash in almost 60 years. The department looks forward to making this an annual tradition.

Gaylon also participated in a number of on-campus activities outside of the department last year. He and Jim Brown led a session of COL-401 Senior Colloquium based on several of Galileo’s writings. While a few of the students had prior exposure to Galileo through an astronomy or physics class, most had not, and they found these works more difficult than their prior readings from Homer, Plato, or St. Augustine; it seems we still have a lot of work to do in demystifying science in the liberal arts. Gaylon was also a member of the committee which selected the three Lilly Scholars for the upcoming year, a role he relished after serving on a number of scholarship committees in the private sector for over two decades. And lastly, he was invited to sing “Mary, Did You Know” at the 53rd Annual Christmas Festival of Music & Readings and found it to be a highlight of his time at Wabash.



**Nathan Tompkins** finished his fifth year as a member of the Physics Department and is looking forward to working in the laboratory with students this fall. This past year he taught the Physics I/II - Algebra sequence entirely in-person again using a new free open source textbook.

He also created a new special topics course, Nonlinear Dynamics & Chaos, and returned to teaching the upper level electromagnetic the-

ory course (PHY 314).

This past year Nate continued working on developing microfluidic systems without photolithography with significant updates to the laboratory. This work and work from recent students was presented at the Gordon Research Conference on Oscillations & Dynamic Instabilities In Chemical Systems in Boston this summer. He also began as a guest editor for a methods collection at the online video journal *JoVE*. His paper with Professor Gunther called “Color Vision Deficiency and Teaching Electromagnetism,” will be appearing in *The Physics Teacher* soon.

This summer Nate got married to Jackie McDermott at a ceremony in Crawfordsville (photo below). Many faculty colleagues from the college were in attendance. They were joined by family and friends from across the country and around the world.

In the fall Nate intends to continue working on pattern formation in the laboratory and continue to upgrade the microfluidic fabrication facilities within the Physics Department. A plasma chamber has been ordered and other optical upgrades will be coming soon. The Pattern Lab already includes two 3D printers, a combination CNC mill/laser cutter, automated inspection microscope, data collection stereoscope, rate controlled fluid injectors, pressure controlled fluid injectors, a planetary mixer for PDMS casting, PDMS curing oven, and vacuum chamber for degassing.

This upcoming year Nate is looking forward to teaching the Advanced Lab courses for the first time. He is currently developing new projects to include. He will also be teaching the sophomore sequence and upper level Classical Mechanics courses again.



## Student News

### Graduating Seniors

Five physics majors (Reese Fokine, Joseph "Joey" Forchetti, William "Will" Lillis, Caleb Powell, and Andrew Rippy) graduated this year. We also had one minor, Yuhao "Jerry" Jiang, wrapping up a year early to attend Columbia University in the fall as a 3-2 engineering student.

Three of the majors will be going on to graduate school in computer science: Lillis to the University of Massachusetts-Amherst, Powell to Auburn University, and Rippy to Carnegie Mellon. Forchetti will be attending law school at Notre Dame, while Fokine is a Damper Technician/Engineer with Rahal Letterman Lanigan Racing. Good luck to everyone in their new positions!



Photo Caption: Students and faculty on the steps of Goodrich after graduation. Top row (left to right): Prof. Krause, Prof. Ross, and Prof. Tompkins. Bottom row: Will Lillis, Reese Fokine, Joey Forchetti, Andrew Rippy, and Caleb Powell.

### Awards Chapel

The Awards Chapel was back in-person this year. Elijah Scurlock (below left) was this year's winner of the Fuller Prize for the most outstanding junior physics major (below right). Senior Joey Forchetti (below right) won the Physics Department writing prize for the paper he wrote for last summer's internship at Notre Dame. Both received the *Feynman Lectures in Physics* from Prof. Brown. Senior physics majors won three of the six Mackintosh fellowships awarded this year for post-graduate study: Joey Forchetti, Will Lillis, and Andrew Rippy. Finally, Joey Forchetti won the James E. Bingham Award, Andrew Rippy won the George E. Carscallen Prize in Computer Science, and Will Lillis won the J. Crawford Polley Prize in Mathematical and Computer Science. Congratulations to all!



The guys wanted one final group photo after the senior dinner. Left to right: Caleb Powell, Andrew Rippy, Reese Fokine, Will Lillis, Joey Forchetti, and Yuhao "Jerry" Jiang.



## April Celebration of Student Research Poster Session

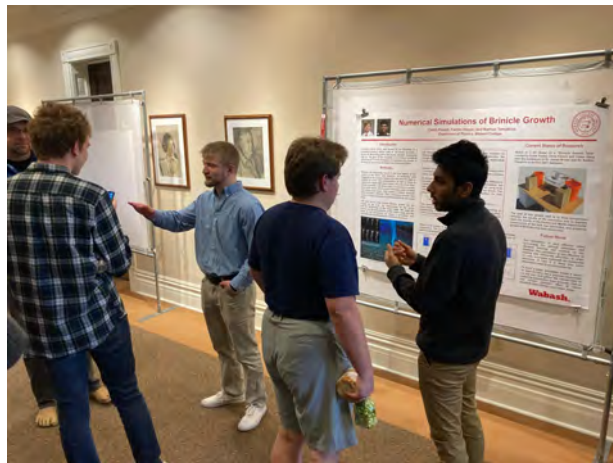
The year's annual Celebration of Student Research, Scholarship, and Creative Work was held in April. Two groups of physics students presented posters this year:

- Kazi Fardinul Hoque ('24) and Caleb Powell ('22) [Shown at the right explaining their work]: "Brinicle Pattern Formation using Point Models in Python"

A Brinicle is a downward-growing hollow tube of ice enclosing a plume of descending brine formed beneath developing sea ice. Brinicles play an important role in heat circulation throughout the world's oceans. In our paper, we use data from previous studies on Brinicles to model a simulation of Brinicle formation. In modeling Brinicle formations, we used advection (shift downwards) and diffusion (spreading out). Additionally, the model also accounts for temperature change and salinity of water to simulate conditions similar to that of the ocean floor where Brinicles are observed. Finally, the results from the simulation showed a  $t^{1/2}$  relationship between growth height and time which is the widely accepted correlation among the scientific community in the subject.

- Caleb Powell ('22): "Applications of Single Board Computers"

Single board Computers are complete, functioning computer in which the microprocessor, input/output functions, memory, and other features are all built on a single circuit board. These board, while functioning as complete computers, are typically very cheap. In this poster we will be exploring some of the applications that single board computers have to the scientific world. To demonstrate these applications, I will be showcasing an oscilloscope built by some small circuit components and a cheap Arduino Uno.



## Summer Research

Many of our students found internships this summer. Here are some that were more physics-related:

- Gabe Cowley ('24) interned at Portland State University conducting research in numerical analysis. He was able to join via Zoom the Wabash physics/mathematics/computer science student research meetings on Fridays. Gabe's internship was funded through the Henry Fund.
- Nikolai Jones ('24), shown at the right, worked with Dennis Krause exploring the consequences of a quantum particle being in the forbidden region of a potential. They turned their attention to a particle that is "barely bound" in a 1-dimension square well, which can have a probability arbitrarily close to unity of being in a region forbidden by classical energy arguments. They then applied the formalism of QuUPs (Quantum Unstable Particles) developed by Krause and Zach Rohrbach ('12) to an unstable barely bound particle. They showed that the barely bound quantum particle would decay faster than a classical unstable particle in the same potential well with the same total energy. Nikolai's work was supported by the Haenisch-Salter Fund.
- Elijah Scurlock ('23) participated in the Research Experience for Undergraduates (REU) Program

hosted by the Triangle Universities Nuclear Laboratory (TUNL). He did research regarding cross section measurements for natural samples of molybdenum and iridium using the tandem Van de Graaff accelerator in the basement of the TUNL building to irradiate targets. The targets were then counted using germanium detectors, and he analyzed the data. On the less glamorous, but still important side of research, he was also tasked with maintaining the germanium detectors by making sure that they constantly had a supply of liquid nitrogen.



## Getting Back to Normal...Almost...

### Opening “Cookout”

We held our usual opening lunch with students and faculty at the beginning of the school year, but, as you can see below, the food was from Subway, rather than from the grill. And we're masked up. However, Prof. Krause will be grilling burgers, brats, and dogs come September. Also shown below, Jim Brown is describing his research.



### Cookies at 4:00

Cookies at 4:00, our weekly break after lab with students in the Society of Physics Students lounge, resumed after spring break. Below, Andrew Rippy ('22) gives it a big thumbs up.



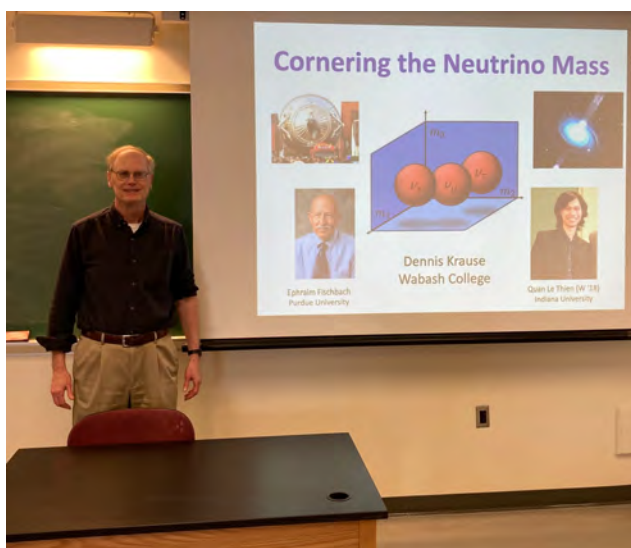
### Surprise!!!!

Gaylon Ross's PHY 315 (Quantum Mechanics) students surprised him with cake on his birthday.



### Physics Colloquium

In the spring, Dennis Krause gave a physics colloquium on his research on the neutrino mass. Look! No mask!





## Sigma Pi Sigma Returns

Founded in 1921 at Davidson College in North Carolina, Sigma Pi Sigma is the physics honor society housed within the Society of Physics Students. It exists to honor outstanding scholarship in physics; to encourage interest in physics among all students; to promote an attitude of service among its members toward their fellow students, colleagues, and the public, and to provide a fellowship of persons who have excelled in physics.

Wabash College became the 99th chapter of Sigma Pi Sigma in 1955. The first class was inducted on May 1, 1955 and included students Fred Elder, Daniel Olds, and Wayne Broshar and faculty member Arthur Kovacs. From 1955-1964, the chapter inducted 31 members and was active in bringing a number of outside speakers to campus.

However, the Wabash chapter then became dormant until this year. Gaylon Ross single-handedly revived the chapter from its 58-year hiatus, organizing a banquet and ceremony in the Elston Board Room of Trippet Hall which inducted five new members in April. Inductees were seniors Joseph (Joey) Forchetti, William (Will) Lillis, Caleb Powell, Andrew Rippy, and junior Elijah Scurlock.



Everyone enjoyed the meal catered by Bon Appetit.



Gaylon Ross emceed the induction ceremony, which included the history and mission of Sigma Pi Sigma.



This year's  $\Sigma\Pi\Sigma$  inductees (left to right): Elijah Scurlock, Caleb Powell, Andrew Rippy, Joey Forchetti, and Will Lillis.

## Alumni News

### Updates

Since our last newsletter, we've heard from...

- **Ke Chiang "Johnny" Hsieh ('63)** published the book, *Neutral-Atom Astronomy: Plasma Diagnostics from the Aurora to the Interstellar Medium*, with Eberhard Möbits. From the cover jacket: *After Wabash College's BA, Hsieh's works in cosmic-ray physics using satellite-borne particle telescopes landed him The University of Chicago's PhD. Since 1971 he has been at the University of Arizona. His team designed the twin neutral mass spectrometers on the Soviet Halley probes, which were used to measure the coma's gas density as Vega 1 & 2 flew by. Later he participated in the ENA measurements on SOHO, IMAGE, Cassini, Mars and Venus Express. He served on NASA's Inner Magnetospheric Imager Science Definition Team (1991–1995), assisted Taiwan's first satellite program (1992–1994), chaired American Physical Society's Committee on International Freedom of Scientists (1997), and elected APS Fellow (2000) for his pioneering work on ENAs in space.*

- **Erich Weinfurter ('78)** is a retired Nuclear Engineer, but still contracting as a Senior Nuclear Operations Instructor.

In his career he held the positions of Systems Engineer, Unit Reactor Engineer, Superintendent of Reactor Engineering, IT Systems Engineer, Shift Technical Advisor (Shift Control Room Engineer), Senior Operations Engineer, Senior Operations Instructor, Construction Supervisor/Field Engineer, and Project Manager. A Qualified Reactor Engineer with a Senior Reactor Operator certification, he was stationed at Quad Cities, River Bend, Grand Gulf and Browns Ferry Nuclear Power Stations during his 40-year career.

When not working, he is a Military Historian, and WW2 Re-enactor. Being hands-on, his shop and home are filled with ongoing projects, he likes to think that there are few things mechanical or electronic that he can not fix. He is an Extra Class Ham Operator (WU5I), Volunteer FCC Examiner. He was also a reserve Police Officer/Deputy Sheriff for 16 years, and am still a Volunteer Fire Fighter with 30 years of service. Living in the Central US for most of his life from the Upper Peninsula of Michigan to Louisiana, Indiana to Kansas, attending both Wabash College (Physics) and Iowa State University (Physics and Nuclear Engineering). He retired from Entergy in 2014, and has been an independent contractor ever since.

- **Andrew Skowronski ('15)** decided to try to move into software engineering as a break from physics

with the intention of going back to grad school at some point. This culminated in him getting a client support role at a company that provides financial software. From there, he worked his way into a software engineering apprentice role and was hired on as a junior software engineer after that. He worked the job for a few years and was recently promoted to a senior software engineer.

- **Cameron Dennis ('16)** received his Ph.D. in physics from the University of Oregon. Since his dissertation defense was virtual, he sent us a link on Zoom so Profs. Brown and Krause could see his impressive work, which included a paper published in *Physical Review E* with 2021 Physics Nobel Laureate Giorgio Parisi. Cam is now taking a joint post-doctoral position with Andrea Liu at the University of Pennsylvania and Lisa Manning at Syracuse University.
- **Karl Prasher ('17)** recently got married and is now living in Atlanta, GA. He is a product manager at a tech company that was acquired by Redfin, the real estate listing platform. He occasionally reminisces of physics classes during the day, comparing them to his day-to-day job. "I can honestly say that Wabash physics classes were much, much harder than what I'm currently doing. For that, I'm thankful for preparing me maybe not as much as you hoped, but you all did a great job."
- **Aaron Wirthwein ('17)** defended his physics Ph.D. thesis, "Collision Dynamics of Bose Einstein Condensates: Computational-theoretic Exploration at the New Frontier of Cold Atom Physics in Space," at the University of Southern California. He's been working with a group at NASA's Jet Propulsion Laboratory working on cold atomic physics aboard the International Space Station. His duties have been to devise interesting experiments to perform in microgravity and justify the efficacy of these experiments through numerical simulations. If that wasn't enough, he was also getting married this summer, and has accepted a lecture faculty position at USC.

We apologize to anyone we missed, and for misspellings or other mistakes made while editing the material sent to us.

In the future, we would be happy to include your news and comments in our newsletter. Not only is it wonderful to hear from you, it is also very useful for us to learn what our alumni are doing and how they got to where they are. Our students wonder what one can do with a physics degree and it is great to have alumni stories to share with them.



## Alumni Colloquium

Adam Fritsch ('09) returned to campus in November to give a physics colloquium on his research on nuclear structure. He is an associate professor at Gonzaga University and was on sabbatical doing work at the Edwards Accelerator Lab at Ohio University.



## Tyler Buresh is "Navigating the Next Generation"

Tyler Buresh ('12) was featured in the spring edition of Wabash Magazine. Tyler is now an assistant professor of naval science in the U.S. Navy's ROTC program at the University of Notre Dame. The article, which describes how he got there along with some great photos, can be found online at:

<https://www.wabash.edu/news/story/11926>



## Big Bash

We were thrilled to be able to hold a reception for our alumni during this summer's Big Bash after two years off due to the pandemic. It was great to meet the families and catch up. Below Zach Rohrbach ('12) and his family are shown chatting with Gaylon Ross, Jim Brown, and Nikolai Jones ('24).

We invite all physics alumni to attend our Big Bash open house next year. Please come share your stories of Wabash and experiences since you graduated. Check the schedule of events for the time and location.



## Internships Wanted

Do you have internship opportunities in engineering or technical fields that would be of interest to a Wabash physics major? Please let us know so we can forward that information to our students and the Career Center.



Find us on:  
**facebook®**

Keep up-to-date on what's happening in the Physics Department through our Facebook page:

<https://www.facebook.com/WabashCollegePhysics>

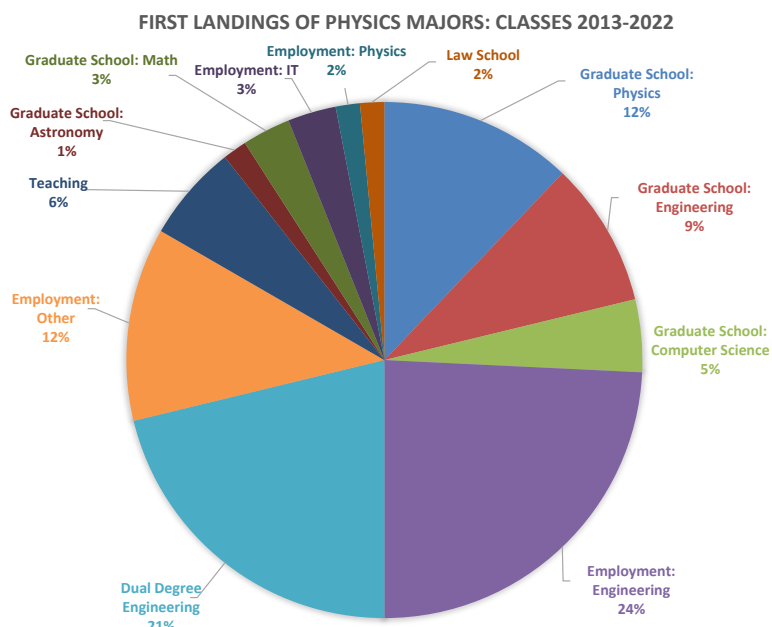
## What can you do with a physics degree from Wabash?

### Some Graduate Schools and Companies

#### Accepting/Hiring Recent Majors

Stanford University  
University of Colorado  
Purdue University  
Indiana University  
New York University  
U. of Oregon  
U. of Minnesota  
U. of Notre Dame  
U. of Michigan  
Michigan State U.  
U. of Cal., Santa Barbara  
U. of Southern California  
Carnegie Mellon U.  
Auburn U.  
U. of Mass.-Amherst  
Florida State U.

Apparatus  
Axiom  
First Gear  
ELANCO  
Apparatus  
Epic  
Trans-United  
Rolls-Royce  
Backstop Solutions  
Peerless AV  
J.P. Morgan Chase  
FAAC, Inc.  
F. A. Wilhelm  
Quest Global  
Ontario Systems  
RQAW



## Thank you for your support!!!

The Physics Fund is a special fund established specifically to support physics student-faculty research at Wabash. In the past, we have used this fund to purchase laboratory equipment and provide summer internships—we never want to turn away an eager student!

We thank Jim Clynych ('67) and Dennis Henry ('67) for establishing funds which supported two research interns this summer, and the Rippey family and Kenneth Crawford ('69) for funds which will support future students.

We thank C. D. Livengood ('64), Dennis Henry ('67), and Taner Kiral ('17) for their support of the Department over the past year, and all our alumni and friends who in previous years have provided funds which continue to support internships, student travel, departmental prizes, library book purchases, and senior dinners.

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