Drake
Department of Physics and Astronomy

College of Arts & Sciences
Fall 2017

Message from the Department Chair

The challenges of teaching and performing science in the 21st century cannot be understated, but the students, faculty and staff of the department continue their work with dedication and enthusiasm.

After undergoing extensive renovations the department now has new state-of-the-art, collaborative laboratories and classrooms. This has allowed the teaching faculty to explore and apply innovative techniques and enhance the learning experience of the students.

The recently-adopted physics and astronomy curriculum allows for more flexibility and includes a study abroad option.

New workshop-style advanced courses have been successfully offered, as well. In addition, the department engages in intense outreach and recruiting activities, such as visiting high schools in the area. These developments have resulted in historically high enrollment for the past two years with a total of 53 students currently pursu

ing degrees in physics and astronomy.

The importance and the level of service in courses has also been enhanced, as the number of students needing science education increases.

The department maintains its long tradition of engaging the students in meaningful research. Many students have presented their work at conferences, or have coauthored peer-reviewed articles. A new dimension to research activities has been the foundation of a student-led, space physics collaboration, which promotes the excitement of inquiry-based learning.

The department has benefited from the construction of the new STEM building with an allocated biophysics laboratory and an astronomy observation deck.

Dr. Athanasios Petridis
Drake University

Inside this Issue

Where are they now?

Graduated Seniors

- **Amelia Santrach**
  Washington University for electrical engineering master's program
- **Paxten Johnson**
  Serving in Airforce
- **Courtney Mueller**
  University of Swansea for archeoastronomy
- **Sean Buczek**
  University of Florida Central for molecular physics
- **Joel Venzke**
  University of Colorado Boulder for atomic physics
- **Joseph Mullen**
  Job in financial data analytics
- **Taylor Harville**
  Iowa State University for physical chemistry
- **Daniel Deeter**
  University of Minnesota for theoretical physics
- **Christian McMurray**
  Took a long trip to Indonesia
- **Jesse Kovak**
  Forest Ranger

Year in Review

Fall 2016 – Fall 2017

Department News

- The renovations of Harvey Ingham Hall are officially complete. These improvements have provided the physics department with state- of-the-art laboratories, new offices, updated classrooms, and a physics lounge for students and staff.
- A two-week summer camp was held this past June for high school students interested in getting a taste of college-level physics and astronomy. See "One Time at Physics Camp" for more details.
- The department continues to host a stream of guest speakers for students and faculty to enjoy. Two speakers were John Vermedahl, who spoke about his experiences working for NASA's space shuttle program, and Mark Jarett who talked to students about applied physics and engineering.

Student News

- In the 2016 year, eight students graduated from the physics department, and in 2017, three students graduated.
- Many awards have been given out to deserving students this past year. Daniel Deeter received the Paul Helmick Award for best graduating senior, Katie Huber received the Paul and Dorthy Helmick Award for best student in their junior year, Jamie Flanagan received the John Vermedahl Award for most positive derivative first year, and Ian Ruh of Stillwater, Minnesota won the Physics Prize.
- This year marked the establishment of a student-led space collaboration. 15 students comprised of all grade levels are participating in the endeavor. See "The Island of MISSFIT Toys" for more details.
- The recently graduated student, Daniel Deeter, presented his research on quantum information theory last year at the fall meeting of the Division of Nuclear Physics at the American Physical Society.
- The Society of Physics Students continues to be an active group on campus. Last fall members traveled to Boulder, Colorado to visit the National Institute of Standards and Technology, and then climbed Mt. Bierstadt. During the year events are put on, such as the "Ask a Physicist Booth," and "Do You Know More Pop Culture Than a Physicist."

Faculty and Staff

- This fall, Dr. Adina Kilpatrick received a promotion to the positon of associate professor with tenure.
- Dr. Klaus Bartschat received the Will Ellis Prize for his study of ionized gas from the American Physical Society.
- Dr. Charles Nelson instructed the ten students that attended the 2017 summer camp. Herb Folsom assisted in accompanying lab activities.
- Herb Schwartz received a distinguished service award for over 40 years of service at the Drake Municipal Observatory.
- Adjunct instructors Dr. Samantha Fonseca and Dr. Nicolas Douguet moved to Florida after greatly contributing to teaching and research. Fonseca is now at Rollins University where she is a tenure-track assistant professor, and Douguet has a position as a full-time researcher at the University of Florida Central.

LIVE LONG AND PROSPER | Department students and faculty mingled at the fall social, which doubled as a celebration of Dr. Adina Kilpatrick's tenure. For more photos, like our Facebook page: Drake University Department of Physics and Astronomy.

Humans of Harvey Ingham

ANNIE FURMAN, Drake astronomy student

by Jamie Flanagan

Even though I walk the halls of Harvey Ingham almost every day, I don't feel as though I know many of the faces that pass by me, or even many of my fellow students. I set out to remedy this, starting with someone I know fairly well, but wanted to learn more about. Her name is Annie Furman and she's a sophomore majoring in physics and astronomy. While I know many of her goals and aspirations pertaining to her major, I wanted to delve a little deeper, so I brought up the question, what are your passions besides astronomy? She was quick to answer: music.

"I've been into music since I was a little," Furman said.

She feels music can help her grow not only mentally, but also emotionally. Furman uses music almost as an outlet for the stress brought into her day to day life, and she "never gets bored of it."

When I ask her about a person who has impacted her life, she struggled to answer,

"I feel like this question can be answered with two parts," Furman said.

She continued to explain that at home, her little sister, Molly, and her family in general are a huge part of her life.

"They've been really really supportive of me and my life, especially my sister. She has pushed me to grow in new ways and adventure and reach beyond what I think I'm capable of," Furman said.

When I asked her to expand on the second part of her answer, she replied by saying that being so far away from home has forced her to find new people here at Drake to help fill the empty spots her family no longer fills while at school.

"My friends at school have really picked up from my sister and have also really pushed me to be the best version of myself I can be," Furman said.

While we went on to talk a little more about her time at Drake, I brought up this one question: what is your biggest struggle right now?

Being from Texas, Furman stated that the separation from her family has definitely taken a toll on her.

"My little sister just started high school this year and my family also has other personal issues going on that I wish I could be there to help out with, but I know I can't," Furman said. "So, it's hard being that far away from my family, especially when a lot of changes are happening for the better and the worse."

She then went on and took a positive turn on the biggest struggles she facing right now. "It helps us all grow. We're all just growing in our own ways."

In finishing up the interview, Furman wanted to say one last thing about Harvey Ingham and the people in it.

"This campus is incredible and the people here are incredibily nice and genuine," Furman said.

She feels as though we're doing an amazing job upholding the traditions and legacies left behind for us. Because of this, I want to continue to set out to find more people like Furman around Harvey Ingham. I want to discover more about these students who are making the physics and astronomy department here at Drake so unbelieveable.

Photo by Jamie Flanagan

The Island of MISSFIT Toys

The new astrophysics/aerospace research group investigates forms of radiation shielding

by Lórien MacEnulty

The island of MISSFIT toys is actually more of a conference room, with a whiteboard blackened by all of the equations it carries. The room is busting at the seams, because it holds much more than unwanted polka-dotted elephants and airplanes that don't fly; in fact, it advertises an imaginative range of the physicist's favorite toy of all: the mind.

MISSFIT is the new research group on the Drake University campus, assembled and promoted by Dr. Athanasios Petridis, head of the department of physics. It stands for Magneto-Ionization Spacecraft Shield for Interplanetary Travel, which is precisely the contraption the researchers seek to design. Detailed below are its endeavors in the field of aerospace.

The Problem

Why has NASA procrastinated the dispatch of manned missions to Mars until the 2030's?

There are several reasons, almost all of which account for necessary advancements in technology to give the expensive pursuit the most likely chance for success. MISSFIT is taking part in a piece of these advancements; the development of a shield to protect astronauts from the tragic effects of more than a year exposed to intense radiation.

"NASA and really anyone who is looking at traveling to Mars in the near future has the problem that humans don't really belong in space," said Katrina Sletten, a senior physics, astronomy, public relations major, and MISSFIT member.

Radiation is known for its detrimental biological effects, or more specifically cancer. From a physical standpoint, radiation is energy that travels in the form of waves or subatomic particles. When these high speed particles interact with living cells, they deposit the excess energy, sometimes directly slicing through organelles or causing disrepair to DNA strands. While the human body is evolved to withstand some bombardment, the damage is irreparable past a certain threshold.

Gratefully, the Earth's magnetic field deflects the large majority of interplanetary radiation, which saturate the upper levels of the atmosphere in two forms: solar and cosmic radiation. Solar energy is excess energy from the sun, mostly made up of a consistent river of protons. Depending on the sun's flaring activity, the radiation may swarm in heavy dosages pointed towards the manned spacecraft in question and threatening any human survival on board.

The second form are galactic cosmic rays, or GCRs. From whence they come, researchers do not precisely know, although it is hypothesized that they originate from distant star nebulae or galaxies.

Earth is surrounded by a giant magnetosphere, one that protects the moon, as well. It's the original force field, if you will. The radiative particles are de-ionized, or lose their energy, in the ionosphere, often emitting visual light that congregates at the poles to exhibit the phenomenon we call aurora borealis, the Northern Lights.

"But this is not the case when they go further away [from the moon]," said Petridis, supervisor of MISSFIT. "It's one of the biggest problems because it is estimated that people will die because of this radiation, or they will get very serious diseases before they even arrive on Mars."

Researchers for MISSFIT, as well as a few other international committees such as the European Space Agency (ESA), are committed to investigating this issue further.

"This is looking to be a multi-year research project," said Zachary Fisher, a junior physics, mathematics and computer science student. "Right now, we are in the initial data gathering stages, and seeing if things are even possible. But assuming that all goes well, we might end up creating a device that would be on a spaceship in 2030."

The MISSFIT Group Dynamic

If students are enthusiastic about a particular topic, they will learn better, according to Petridis. Such was the mentality that inspired his the research opportunity for students.

"We want to have an inquiry based experience for our students that is integrated in the vertical dimension," said Petridis. "In other words, it includes all possible years. Students can interact with each other, and the younger students can learn from the older students, if possible, and sometimes vice versa."

In the midst of the Fall 2016 semester, the Drake professor spent time gauging interest in the project, and attempting to recruit at least four enthused supporters.

Outside attendance of the meetings held every Friday afternoon, each member has been designated a particular task to investigate a specific component of radiation protection. There are even task forces, comprised of amalgamations of younger and older students, for more technically advanced topics in physics.

"Nobody has any idea how to do what we're doing," said Katie Huber, senior physics major. "But we are all doing it together, and figuring it out together as we go. It's still very early, but the implications of what we're doing are pretty significant and relevant to what's happening."

As secretary/historian for MISSFIT, Huber maintains an organized list of all assigned tasks and partitions, in addition to updating member progress reports and engaging in the tasks themselves.

"In the end, this involves ideas from many different parts of physics, including nuclear and particle physics, electromagnetism, atomic physics, and even chemistry," Petridis said. "So people can learn something from all those areas, and most of all they will learn

how to research certain topics and come up with answers, including answers that will require computations."

In this way, MISSFIT is not only involved in pioneering aerospace research, but the group is breaking traditional educational boundaries.

"It is interesting to learn how a collaboration works," Petridis said. "It's a different kind of learning compared to your standard course."

The Solution

"It will be good to learn from nature itself," said Petridis. "Nature has solved the problem."

Ultimately, there are two basic categories of protection that may accompany a spacecraft to Mars: passive protection and active protection.

Passive protection is labeled as such because it does little else but insulate. Like a condensed form of the ionosphere, the passive protection would systematically entrap radiation before it reaches the inside of the spacecraft: a tangible shield.

At first glance, a good candidate would be to surround the spacecraft with lead; its protective qualities greatly outweigh many other elements. The problem is that lead is considerably heavy, and weight is always an issue during liftoff.

There are other candidates for passive shielding. Among those that MISSFIT is investigating are hydrogenated boron-nitrogen nanotubes, or HBNNTs, as well as Demron. The structures are lightweight, withstand very high temperatures, and are flexible enough to be interwoven in the fabric of spacesuits.

The second form of radiation shielding, and at the forefront of MISSFIT research, is active. This category extends to the active deflection of ionized particles with a condensed magnetic field and ionosphere similar to that of Earth's.

"Because we are looking at creating a pseudo-Earth type contraption, looking at magnets is a big part of it," Sletten said. "We need to see what would be better; using a permanent magnet, or electromagnets, seeing what shapes we can make with them, to mimic Earth's atmosphere that protects us from radiation ourselves."

Much of the task allotments are gathering data in eventual contribution to a design that will be tested computationally and through advanced simulations. The members are mostly concentrated, however, on developping an algorithm to determine the trajectory of a particle as it goes through a magnetic field.

"It is a really cool experience, getting to work on a project that may have a huge impact on the future of space travel," said Sletten. "Being able to say that you worked on a project that is now used to transfer people to Mars would be a cool outcome."

No matter the end result that the researchers achieve, one thing is absolutely certain. Anyone who finds themselves to be a Rudolph among reindeer is welcome to the island, or conference room, of MISSFIT toys.

"We are open to new students joining at any time, be they physics majors, be they chemistry majors, be they journalism majors," Fisher said. "As long as they are willing to put forth some effort into the research and help provide solutions to the problems that we're facing, or help us communicate with the people that can help us solve these problems. The more the merrier."

Photo by Lórien MacEnulty

One time at Physics Camp...

by Katrina Sletten

The Drake physics department welcomed 10 high school students from the surrounding Des Moines area to get a taste of college level astrophysics this summer. The program ran for two weeks, where campers came to the Drake campus for a few hours a day, visiting occassionally the Drake Municipal Observatory.

The main focus of the camp was to engage students in astronomy and physics through hands-on activities in a fun, collaborative environment. During the initial phase of the camp, the students were introduced to the necessary content needed to complete the research-based project; calculating the Hubble constant and age of the universe.

The camp was led by Drake's Associate Professor of Astronomy and Astrophysics Dr. Charles Nelson, and assisted by Herb Folsom, adjunct instructor of astronomy who helped with laboratory activities.

The camp began in the 1970's and lasted for a number of years, but was eventually put on hold due to lack of funding. It was resurrected this past year with the help of Drake alumni James Holsapple, who is now chairman of the department of neurosurgery and program director of neurological surgery at Boston General Hospital.

The department will continue to host the camp for at least two more years, and is continuing to search for more donor support so the camp can grow.

The project that the students worked toward was an adapted, sophomore-level astrophysics lab where students use Cepheid variables to find the Hubble constant and the age of the universe.

The first step of the project for the campers was to look at light curves for Cepheid variable stars, and measure the periods of rotation. Once that was complete, they figured out the period-luminosity relation. The students came up with their own trend line for period-luminosity relation, and then applied it to Cepheid galaxies in M100, where they were then able to figure out the Hubble constant. In the end, the campers created a research poster to document the work completed and their findings.

The instructors employed other activities to engage the students in new and enjoyable ways, such as watching the movie Contact, investigating the science behind boomerangs by playing with them, and observing line spectra.

"We want to attract students to physics and to our department specifically, but of course the usefulness goes beyond that," Dr. Athanasios Petridis said, chair of the department of physics and astronomy. "I think it is very important for high school and middle school students to be exposed to science as much as possible within their courses and outside of their courses to develop some interest and manage to maintain their curiosity. Because the data shows that curiosity of students dwindles as they become older. Maybe that is because of the way we teach science in high schools. So we are trying to counteract that."

Overall, the camp successfully provided an atmosphere for the students to get excited about science through a mix of research experience and fun science-related activities. According to Nelson, it is important to engage students during the summer, to keep their minds fresh and to make sure science is fun, both of which this camp achieved.

"We can explore something cool like the expansion of the universe in a fun setting that doesn't have grades associated with it, and so all the pressure comes off and its all about having fun with science, and what could be more beneficial than that?"

PHYSICS CAMP 2017 From left to right, Rocky Vizcarra, Reece Riley, Charlie Nelson, Matthew Gerling, Chase Johnston, Rabsa Naseer, Madelyn Klinkefus, Kristin He, Katie Aguayo, Herb Folsom.

An Incidental Quest for the Holy Grail

How Cassini propagated the search for extraterrestrial life

by Lórien MacEnulty

Speculating the existence of life outside of Earth's sphere of influence is, as best, mathematically labyrinthian. It's like trying to cast a trend line with only one data point. The Drake Equation and similar methods, in their variable complexities, offer an indication as to what could be out there, but it's all probability; aneducated guess.

The solution, of course, is to gather more data points; to find life, even if it is merely microbial. This ongoing search, while not directly integrated in the mission statement, was incidentally propagated by the Cassini spacecraft before its inevitable demise on. Sept. 15.

The Cassini-Huygen's mission, dispatched in 1997 on an extended voyage to the Saturnian system, was a joint endeavor of the European Space Agency (ESA), the Italian Space Agency (ASI), and NASA. The quest sought to "improve our understanding of how giant planets - and families of planets everywhere - form and evolve," according to NASA's goal outline.

As the fourth probe to study the Saturn system, Cassini's perspective usurped the scientific community's understanding of the planet. The craft confirmed that the space between the planet and its rings was virtually empty. The Huygen's Lander found itself on the surface of Saturn's largest moon Titan, whereupon it discovered lakes of methane and ethane. Scientists calculated a nearly perfect alignment of the planet's magnetic field and its rotational axis with data Cassini collected, and catalogued scores of previously cloaked moons.

"In that sense, we know so much more about Saturn now than we did 20 years ago, or even 15 years ago," said Herbert Folsom, adjunct instructor of astronomy at Drake University.

In an interview, Folsom enigmatically describes Mimas, a heavily cratered moon that looks in a way like the Death Star in Star Wars.

Methane lakes and Imperial space stations: the Saturn system could easily feature in an Orson Welles radio drama. These arguably impressive discoveries adhere well to the initial goal that justified a multi-national investment of approximately $3.9 billion.

"Another moon, Enceladus, that basically we didn't really even know about...right now, most astronomers think it might be the biggest chance for discovering life in our solar system," Folsom said.

Enceladus (en-sell-uh-duhs) is Saturn's sixth largest moon. In continuation of the Star Wars analogy, think Hoth; the planet is encapsulated in a sheet of ice. In the moon's southern region lies a high concentration of cryovolcanos (ice volcanoes) and spewing geysers. Cassini thus logged evidence suggesting the existence of a subsurface, liquid water ocean beneath the south pole.

"First of all, Cassini was able to image and see those, basically, ice volcanoes, eruptions, and sort of fly through the plume and sample some of the stuff," Folsom said. "And there were hydrocarbons in there. There were the constituents of life."

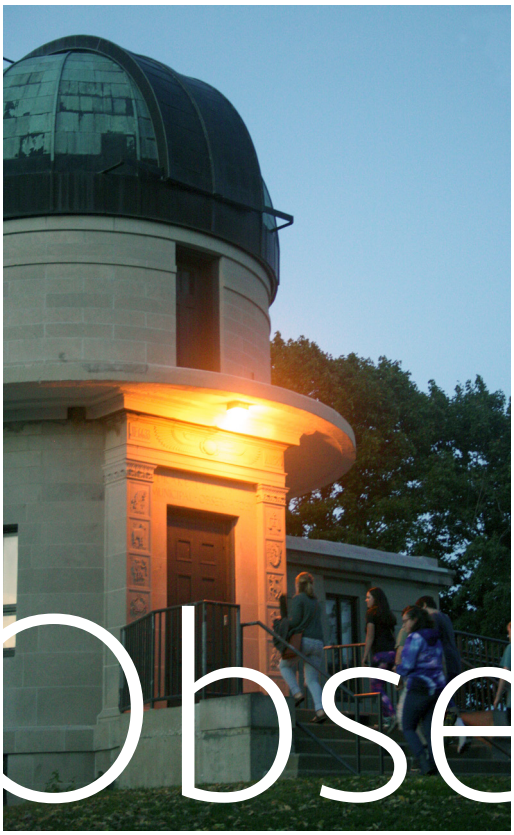
Indeed, according to a NASA press release, Cassini's Ion and Neutral Mass Spectrometer instrument succeeded in identifying the elemental composition of a flyby sample from one of Cassini's geyser ejections. The gas sample contained almost 98 percent water, one percent hydrogen, and the rest a miscellany of other molecules, such as methane and carbon dioxide. According to the same report, these factors make up a large majority of the necessities for life as astrobiologists on Easrth understand it.

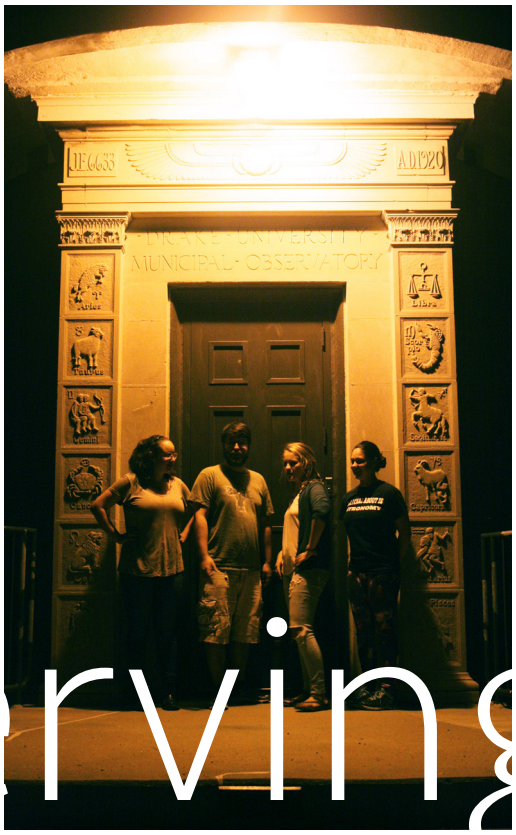
The probability that not one, but two celestial bodies carry independently evolved organisms in one solar system is slim in and of itself. If one extends that to the entirety of the known universe, with its 3,493 catalogued exoplanets orbiting stars in 2,657 exosolar-systems, the conception that life is a rare commodity may find itself utterly dismantled.

"It's the holy grail of astronomy to find life elsewhere in the universe, probably the most significant discovery in all of science," said Dr. Charles Nelson, associate professor of astronomy and astrophysics at Drake University. "The cultural tumult of the notion that alien beings live on another planet and they're intelligent. What kind of god do they have?... Should alien life be discovered somewhere else, the philosophical and religious implications of this, for various sorts of narrow points of view, religiously and faith-speaking, might be turned upside down."

The Cassini-Huygen's mission may not have ventured to space expressly to introduce a bit of existential turbulence in modern philosophy. Perhaps the mission was truly dispatched just to understand the nature of a gas giant. Whatever the case, the 29 nations who invested in the project got more than they bargained for, if only to satiate an inherent and unsourced curiosity. In this way, Cassini incidentally propagated the search for extraterrestrial life, that holy grail of astronomy. And thus, the search continues.

Photo from artists at NASA





Observing the Observers

These are the voyages of the Drake Observatory crew members...

by Lórien MacEnulty

"I want to let you know that you matter. Until you multiply yourself by the speed of light squared. Then you energy."

The chuckles of seven physics students erupt and resonate through the darkness as Annie Furman, sophomore astronomy major at Drake University, recites this joke to me. In another setting, we may have rendered ourselves a nuisance, but we're in the middle of a golf course at nine o'clock on a clear Friday night. We're at the Drake Municipal Observatory, and the skies are perfect for observation.

Furman's nerdy humor doesn't stop there. In fact, if Furman were likened to a character on Star Trek, her observatory coworkers said she'd be Hikaru Sulu, the comic relief of the starship Enterprise.

She cracks me a new one.

"Why is it so hot up in the dome? It's 360 degrees," Furman said.

Furman is, of course. referring to the observatory dome, whose silhouette I can distinguish from a dark blue horizon left slightly burnt by the sunset. The dome holds a massive, 8.5 inch refracting telescope built in 1894, and just below it is a lecture hall filled to the brim with community members. They're listening to Dr. Charles Nelson, professor of astronomy at Drake and observatory director, as he spearheads a discussion on the accomplishments of the late Cassini-Huygen's mission to the Saturnian system.

These lectures, hosted by Drake's department of physics and astronomy and typically headed by lecturer Herb Schwartz, occur every Friday night at 8:00 pm from late spring to October. On clear nights, the lectures are suceeded by sky viewing through two powerful and easily maneuvred telescopes.

But this story isn't about the observatory, nor is it about the unique perspective of the universe this tiny corner of Des Moines provides. This is the story of four crew members, piloting their localized adaptation of the starship Enterprise, boldly going where no student has gone before.

For now, they're waiting for a Friday night lecture to conclude. When it does, this entourage of impassioned astronomers will throw on their game faces instead of cracking nerdy jokes around a journalist's tape recorder. They'll engage the public; answering questions about the telescopes, the observatory, planets and nebulae. They've got customers, and a sky full of discovery to sell.

Katrina Sletten
James T. Kirk

"Yep. I see Saturn."

Dusk has just befallen the golf course when Katrina Sletten, senior physics, astronomy and public relations major at Drake, begins to point out and label celestial bodies as they appear in the sky. Her knowledge base of the ethereal is certainly justified given her choice career path; a communications director or community-outreach official for a scientific organization or planetarium.

On this particular Friday night, the white freckle Sletten identifies as Saturn lies about 45 degrees above the southern

horizon. Sletten positions the telescope accordingly.

"The telescope is relatively new compared to the observatory, I guess you could say," Sletten said. "It is a Cassegrain telescope…we've had it probably since last spring. What's cool about it is it's motorized. So you can type in a star name or a galaxy name, or a Messier object, and it will go to it once you align it."

I peek into the viewfinder; Saturn's form was pristine, a contoured white nugget planed in a black sky. It looked like a negative silhouette of an old man tipping his bowler hat. And just to the left of the brim, which represents the rings, I could see a white speck; Titan, Saturn's largest moon.

Sletten knows the ins and outs of the observatory procedures; of the four colleagues, she's been working at the observatory the longest. Yet even her working knowledge, Sletten said, is ousted by that of Jessica Schertz, a senior astronomy and math major at Drake University.

Jessica Schertz
Spock

"She's Spock, because she always knows what to do," Sletten said. "If I don't know what to do, I'll be like, 'hey Jess, how do you do this?' and she just knows how to do it. In the show Star Trek, Kirk is kind of the outspoken leader, but Spock is the leader that most people listen to the most, I would argue. He's the logical one who knows, in every situation he knows what to do."

Indeed, Schertz speaks softly during our interactions, yet she is no less a leader in the group dynamic. She operates the telescope that captures the Andromeda galaxy in the viewfinder, a faint smudge of a spectacle compared to Saturn.

Schertz demonstrates an array of knowledge on Andromeda as community members inquire throughout the evening, but her favorite celestial body is the Ring Nebula.

"Looking through the telescope, it's just going to be white, a kind of cloudy look to it," Schertz said. "But if you do a long exposure picture with it, it does have some color.…That was the first deep space object I found outside of the solar system, so kind of proud of that one."

Upon arrival at Drake, Schertz had yet to discover an enthusiasm for astronomy as a career. Initially a math single major, she worked as an astronomy lab assistant before signing up at the observatory. Schertz developed her skills as an astronomer alongside friendships with her colleagues.

Nick Gautille
Montgomery Scott (Scotty)

One such friendship that Schertz developed was with Nick Gautille, a junior astronomy major who credits Schertz and Furman for his affiliation with the observatory.

"They kind of roped me into it, and I've been here since," Gautille said.

Gautille's favorite celestial body lies a bit closer to home; Jupiter, the planet that propagates the largest storm in our solar system. This storm, also known as the Great Red Spot, upstages any hurricane our Earth has ever hosted in its turbulent magnitude and age; the storm has afflicted Jupiter's southern hemisphere for over 150 years as science historians have been able to verify.

The Great Red Spot intrigues Gautille, who said he wouldn't mind conducting research investigating Jupiter as a career.

Gautille said that in his years as a student, Drake augmented his mathematic and problem solving ability, enough to make his choice career path a reality.

In terms of the group dynamic, Gautille is both the source and receptor of playful banter amongst the colleagues.

"[The members of the group] are siblings, I guess is the best way to describe us," Sletten said. "The reason I say that is we all work together, but when we're out here, while we get stuff done, we also like to have a lot of fun."

Throughout the evening the group members engage in all types of shenanigans, jousting with puns and witty comments, rapping in unison to Fort Minor's "Remember the Name. "Sletten jests that Gautille has "the aesthetic of a brown bear," an allusion to his beard.

Annie Furman
Hikaru Sulu

"The four of us, Nick, Rena, Jess and I, we are all super close to each other," Furman said. "They are very motivational to me, because I've had heart-to-hearts with them about struggling in physics, and struggling with astronomy. I've had many many heart-to-hearts with them about how everyone struggles in physics. It's a hard major. It's a hard thing to do. They believe that I can get through it."

Furman and I are having this conversation inside the observatory dome, dimly lit with red light and contoured by black, geometric lines that structure the establishment. We are dwarfed by the pedestaled telescope, which Furman says is 121 years old and a staple of the education Dr. David Morehouse received as a student at Drake before becoming president of the university and founder of the observatory.

"I've said many times to my parents and friends and family that I could live in an observatory," Furman said. "I'm studying astronomy for the sole purpose of being an observational astronomer and being able to stay in an observatory forever. It's very quiet. It's intense, at the same time."

Another occupational prospect Furman has in mind is lunar astronomer. Her electronic devices are infested with photos of the moon collected from various telescopes she's encountered. Furman mentions Albireo, the two star system, as one of her favorite celestial objects. Also known as Beta Cygni, Albireo is visually comprised of one bright orange blob and one cyan blue dot located approximately 130 parsecs (430 light-years) from the sun, according to earthsky.org.

The ardor Furman harbors for astronomy emerges in her interactions with the public. One of the lecture attendees, a child, took to following the observatory employee around throughout the evening, asking about the telescopes and the stellar objects within their scope. Furman answered with unyielding enthusiasm and erudition.

"When I'm here [at the observatory], it's relaxing, but its also productive," Furman said. "It's me pursuing what I know I want to do for the rest of my life, yet enjoying myself and finding inner piece. That can be very hectic and hard to find."

The Drake Observatory
The Enterprise

All crews pilot a vessel. Yet the metaphorical starship Enterprise of Drake University finds itself in need of structural development, but want of funding.

"I'd say the sad thing is that the longer I'm here, the more that I notice how much money and love needs to be put into the building and the program itself, because we have an amazing thing here, and the university… they just don't treat it the way it should be loved," Sletten said.

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Observatory lecturer Herb Schwartz said via e-mail that on a clear Friday evening "we will have more than 100 visitors come to the observatory." Even on a rainy night earlier this October, the lecture brought in about 70 community members. With such a public outreach in such an old building, the observatory inevitably undergoes infrastructural erosion.

"The newest renovations made to the Observatory have been painting of the Classroom, a new roof and securing the railings around the walkway around the dome," Schwartz said.

According to Sletten, however, administrators at Drake University do not allow the observatory to take donations or engage in fundraising to compensate for infrastructural damage. Sletten said that marketing endeavors in this sect would prove immensely successful with the observatory's current community base.

"You could easily have a wine and cheese under the stars, and people would come," Sletten said. "People would come and donate money, but we're not allowed to do that. We're not allowed to use the building to fundraise for any reason…And that's really frustrating to me, and to all of us, I think, because we love this place, we spend our time here. There is no place I'd rather be on a Friday night, honestly. And it's so frustrating to me that a place that's so loved by so many people in the community doesn't get the attention, and doesn't get the updates that it needs."

As Scotty in Star Trek: Next Generation said, a ship is only as good as the engineer who takes care of it.

"And from what I can see, the Enterprise is in good hands."

Photos by Lórien MacEnulty

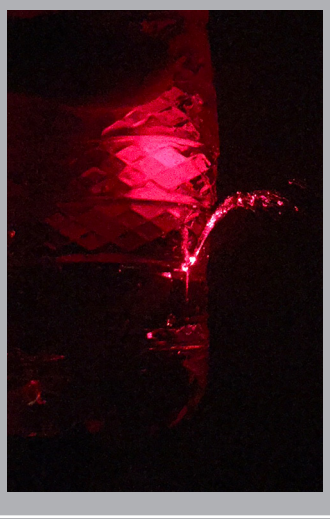
DIY Physics Experiment

Bending Light with Water

by Annie Furman

Although physics can be very challenging there are many aspects of it which can be quite fun.

A really easy and fun experiment you can do at home is one that shows properties of light, such as how it travels, refracts and even bends.



You will need:

- A water bottle (or any clear container to hold water)
- Water
- A laser pointer
- Scissors
- Bucket or sink

Steps:

1) Poke a hole in the side of your bottle/container approximately three inches away from the bottom of the bottle.

2) While holding the hole closed with either your finger or a piece of tape, fill up your bottle/container completely with water. (When you release your finger the water will pour out. This is where you will need to have a bucket or a sink.)

3) Hold your laser pointer directly across from the hole on the opposite side of the bottle. When you release your finger, you will see the light from the laser follow the path of the water as it pours out of the bottle.

The physics behind it:

According to Snell's Law, the light from the laser will change its path upon encountering the water. The laser beam is therefore bouncing back and forth in straight lines inside the bottle, and accordingly inside the stream of water as it flows. This gives the illusion of bending light as it falls from the bottle.

Remember you may need to experiment with the exact position with the laser on the bottle to get the perfect effect. If you are having trouble seeing the light, turning off the lights in the room might make the effect clearer.

I hope you all have fun!!

Insert thing about getting money Petridis said existed.

The Physics Trifecta

How students can take on three majors at once

by Katrina Sletten

If you don't think completing a physics major is hard enough, why not add two other majors into the mix? This feat may seem unfathomable or unattainable to some, but to others it is just their chosen college experience. Recently, the physics department has seen an uncommon amount of students pursuing a triple major.

Unlike some other schools, Drake University does not cap the amount of majors a student may pursue during their academic career. Some students have taken advantage of this system and are setting out to get the most education for their money. Zachary Fisher is a third-year student who is majoring in physics, math, and computer science. Due to the large amount of credits he entered Drake with, he felt "just physics wouldn't be enough."

A double major is common throughout the university, but adding that third major is where things get interesting, and Fisher isn't the only one looking to complete a trifecta. There are a few more than a handful of students within the physics department that set this goal for themselves, which is more than the rest of the student body can say. According to Associate Physics Professor and Physics Department Chair Dr. Athanasios Petridis, some of the more common combinations include physics, math, and astronomy; physics, math, and computer science; or physics, math, and chemistry.

The reasoning for the commonality of those groupings lies within the fact that many of the classes overlap, so it is possible to have a course count for more than one major.

"Being an astronomy major, you automatically have to take all the physics classes for a B.A., and then you have to take half of the math classes which gives you a math minor if you take one extra class on top of that. Just having those classes overlap helps a lot," said Jessica Schertz, a fourth-year student studying physics, astronomy, and math.

While getting a physics degree in and of itself is an impressive mark on the resume, students are always looking for a way to differentiate themselves from others, and completing three majors is one way to do that.

"If you are going to apply for a position at NASA, for example, and they see that you did physics and math and astronomy, they see you did all of that, instead of just studying astronomy," Schertz said.

That may not seem enough reason to go through all the work, but the other benefits to triple majoring are clear to those who chase it.

"The benefits are obvious, you can have careers in different directions and if the majors are related they sort of compliment each other," Petridis said.

According to Fisher, it also provides lots of opportunities for the future since you have more to offer and can get a job right off the bat. However, the most echoed reason for pursuing three majors is the simple enjoyment of the academic areas and the opportunity to explore a broad range of interests.

Though there are things to gain from triple majoring, there are downsides to this ambitious path too.

"You generally have to put in a lot more effort," Fisher said. "You learn how to flip that switch."

To finish the three majors in four years, students often have to take seventeen to eighteen credits every semester to fit all the necessary classes in. According to Noah Smith who is currently a second-year studying physics, math and chemistry, the workload and can create a mess for scheduling.

The downsides may be a deterrent for some, but for Fisher, Schertz, and Smith, they love what they do and the value is clear to them. As Smith said, "You gotta be a certain kind of crazy, but I mean if you are willing to work for it and try it, it's worth it," Smith said.

The students who try for this trifecta have pride and appreciation for the physics department, and the department feels the same for them.

"I guess you could say we are more hard core, because if you take physics and you take all those classes, you can do almost anything because they are so tough here, "Schertz said.

"The students have broad interests and they are very focused on what they want to do, and they are also very capable, which is something that as a department we are very proud of, "Petridis said.

Graphic by Lórien MacEnulty