Every year Purdue University’s Convocations hosts many groups, acts, or performers for students, professors, families, and just anyone across the state of Indiana to enjoy. In the past this organization has gotten celebrities like Third Eye Blind, Hank Williams Jr., and Bob Saget.

This year is no exception, with lectures by Neil deGrasse Tyson, a well known scientist. Mr. deGrasse Tyson got his start doing research on the Milky Way galaxy’s structure, and the formation of stars!

Another big name that will be stopping by Purdue University’s campus is Doktor Kaboom on November 24th! This kooky scientist teaches children real problems associated with rocket science, but in an exciting way. Doktor Kaboom will be turning the stage into his own lab and the audience into his assistant at this performance!

For more information the Purdue Convocations website is: http://www.convocations.org

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Special Guest Speaker—Buzz Aldrin

On October 16, 2013, Buzz Aldrin came to Purdue to speak to students, staff, and the community about pushing our boundaries in space.

Buzz Aldrin born Edwin Eugene Aldrin Jr, is best known for being part of the spectacular Apollo 11 crew. On July 20, 1969, Buzz spent 21 hours on the moon’s surface where the Apollo crew gathered over 46 lbs of moon rocks.

Buzz, was also part of the Gemini 12 crew, (Nov 11-15, 1966) where he made a five-hour spacewalk—the longest and most successful spacewalk ever done up to that time.

In addition to his time in space, Buzz logged over 4500 flight hours as a pilot.
This morning, I made some people happy. Because INSGC was one of the sponsors of the Neil DeGrasse Tyson lecture on September 19 (see other stories, this issue), I was (unexpectedly) provided with some additional tickets for the lecture. Two members of the staff in my IE department had asked if I might be able to find them a seat, and I brought them the tickets this morning. What pleased and enthused me the most is the level of excitement and pleasure they demonstrated when receiving the tickets.

This is a great example of the positive experience that we at INSGC can bring to others when we support opportunities for STEM engagement. As I have previously mentioned in my Director’s Blog (http://insgc-be.blogspot.com/2013/08/locally-grown.html), the challenge may in fact be to identify what do our customers / prospective partners / students want to learn, do, or share. Sometimes it is about going out to them; other times, it’s bringing them in to help us understand what excites them. One INSGC-led project is attempting to take this approach within the context of a “research experiences for teachers” project. Research (to me) is a grand exploration and scouting process. There is a process of providing information about facts and formulae and functions, but real research is not just about piling those facts up. It’s about having tools to go out and solve problems, and make sense of a context that you didn’t previously understand... perhaps a context no one has previously understood. The process of education is not a passive one, as most inspired (and inspiring) teachers will tell you. In my research group’s blog (http://grouperlab.wordpress.com/2013/09/15/eaten-up-with-curiosity/), I recently wrote about being “eaten up with curiosity,” as Rudyard Kipling described Rikki-Tikki the mongoose.

So, what does that sort of experience look like—the well-informed, effectively-engaged, continuously curious citizen as researcher? Well, we have a historical grand exploration and scouting process, which set out from Indiana (Clarksville) in October 1803: The Corps of Discovery, led by Lewis and Clark. Now, you would never send out people into the vast unexplored wilderness unprovisioned. For the Corps, it was medicine and gunpowder and cartography equipment and notebooks: things to go exploring, and make notes, and bring back descriptions of what you found. For an informed, engaged person, the provisions of research are equally important: analysis skills, mathematical techniques, understanding of physical properties and laws. But no one would confuse the provisions for the expedition. They are simply tools to allow you to do a better job exploring. What’s out there? What do we want to know? How do we bring that experience back to others? That’s a bit harder, especially when the territory is vast and your experience is greatly limited. (There’s an ocean out there, or some magical destination that may or may not really exist. Even after the Corps returned, it was hard for most people to believe things like the Badlands, or the Rockies, or the herds of bison, really existed—the explorers had experienced things far outside of the previous experience of those in the United States in 1806.) And this is always a challenge of the researcher. How do you share what you’ve seen and learned with others?

That is one way that I appreciate and enjoy Dr. Tyson: he engages people to do the exploration that they can, and he provides them with provisions to do more exploration if they choose. The stories are accessible, and interesting, and entertainingly presented. And it helps that stars are visible to lots of us, and we want to tell stories about them. But Dr. Tyson doesn’t just entertain. His informative examples are also powerful tools and provisions, useful for a journey of discovery. I have come to see how vitally important it is to find out which exploration journey a person wants to take, and provision them for that journey, as well as other potential journeys and side trips not yet envisioned. (One challenge that a high school teacher has, that I don’t have in my university lectures, is that I can make a better guess as to the range of journeys that an Industrial Engineering undergrad will be ready to take after I have tried to provision them with project design or statistics. It’s still a pretty large range of journeys, so I better make sure my provisions will last, and they don’t leak away or rot over the years to come.)

I love the process of exploration. Through my career I have noted that more information, about more subjects, means more provisions that help me discover and document and describe more about those territories I encounter along the way. Sometimes the information is challenging and new, but that’s okay. Skis and snowshoes don’t seem to be that useful along the Ohio River in September and October, but I can be glad to acquire them along the way to North Dakota, or learn how to make them when I need them. If it is our job to teach the excitement of exploration, and not just the excitement a specific person has for a specific subject, there is an added responsibility to learn about a variety of journeys, and get people ready and well-provisioned for those. I’m pleased that INSGC is able to help with West Lafayette events this fall that excite and engage both kids (Dr. Kaboom, Purdue Space Day) and adults (Dr. Tyson and other general public visits by astronauts). A broad set of offerings provides our audiences with a range of information and a span of topics that increase the value for more people, regardless of their area of interest. In other words, a rich stock of provisions for an explorers set off on a variety of journeys of discovery and experience.
Outreach Affiliate Happenings

Challenger Learning Center of Indianapolis
This learning center offers three fun filled ‘missions’ for students to use math and science to complete their assigned mission. Missions include ‘Rendezvous with a Comet’, ‘Return to the Moon’, and ‘Voyage to Mars’. If this sparks your interest head on over to their website http://www.challengerindy.org

Challenger Learning Center of Northwest Indiana
At the Northwest Indiana Learning Center, they have a special night dedicated to good family fun! Families come and participate in science-themed activities to promote cooperation and communication. For more information go to their webpage at http://www.clcnwi.com

Children’s Museum of Indianapolis
Recently Playscape has been added as a permanent exhibit at the Children’s Museum for an authentic, physical space for young minds. This area features activities like a sand pit, a virtual pond climbing wall, and Blockopolis! For more family fun go to their webpage http://www.childrensmuseum.org

Ethos, INC
A lot exciting events are coming up like Science Spectacular’s ‘Energy, Now and Forever’ with guest like Amazon John and his wild animals, along with a few other friends! This event is happening on October 26th and 27th. For more information go to their webpage http://www.ethosinc.org

IMAX Theater
In Indianapolis the IMAX theater is dishing out lots of fun through documentary films. Films range from harmless butterflies to the biggest fear of the sea, the Great White Shark. IMAX is also showing films on the Coral Reef, Lions, and the Arctic life. For more information go to http://www.imax.com/oo/imax-indiana-state-museum

Terre Haute Children’s Museum
The Terre Haute Children’s Museum offers many fun and exciting activities, including their Health Zone, which allows children to learn how the body works through the Body Viewer and Body Heat exhibits. Check out their website for more information at http://thchildrensmuseum.com

Evansville Museum of Arts, History, and Science
During National Chemistry Week an entire day was devoted to chemistry for kids! One of the professors from University of Evansville demonstrated many exciting chemical reactions. Afterwards children were able to go to seven different stations for more chemistry fun! For more activities visit their webpage at http://www.emuseum.org

Indiana State Museum
Opening on November 16, 2013, the Indiana State Museum in Indianapolis sure is going to have some giant features with their new exhibit, Ice Age Giants! Archeologists have been hard at working digging up remains of the ancient elephants, Mammoths and Mastodons, to put up on display. For more exciting details go to http://www.indianamuseum.org

Science Central
Located in Fort Wayne, Indiana, Science Central is excited to open a new exhibit, Science on a Sphere! This new exhibit is a dynamic, animated global display system to show planetary data on a six-foot diameter sphere. This exhibit is expected to open on Saturday, October 5th at 11 a.m. For more information go to their website at http://sciencecentral.org
Over the past four years Able Flights has been helping disabled individuals accomplish a dream they have had for a very long time, but for most could not afford. In 2012-13, Indiana Space Grant Consortium was pleased to have been able to help in this endeavor with funding. Over the course of this joint program, Able Flights and Purdue they have changed the life of 17 individuals through extensive training to earn their pilots license. This non-profit organization is partnered with Purdue University to give a handful of people every year the opportunity to earn their Sport Pilots’ License. With this license the funded can fly any airplane in the sport category single engine. This year they actually had two trainees earn their Private Pilot Certificate, which allows them to fly any aircraft in the single engine category.

The scholarship recipients are brought to Purdue University during the month of May and part of June for their extensive training program. For six weeks they are put through training from Purdue students and faculty, the same extensive training the Department of Aviation Technology requires. They get up early every morning and go to the airport on Purdue’s campus to fly or go through training. Purdue and Able Flight have special aircraft that has the rudder not on the floor, but connected to the throttle so it can be controlled by a person’s hands.

This past year Able Flights gave this amazing opportunity to five people. The first is Andrew Kinard, who lost both legs to an IED while in Iraq with the Marines. He just earned his pilot’s license and graduated from Harvard with a law and business degree. Next is Deirdre Dacy who was diagnosed with Multiple Sclerosis at 16. She has now been forced to use a wheelchair due to the disorder, but went on to graduate from college and earn a Master of Science Degree with honors. Then there is Young Choi who contracted Polio as a child in Korea, he moved to America at the age of 22 and now has a job as a software engineer. Young wants to change the way people view disabilities in the Asian community and Korea. Warren Cleary was a member of the U.S. National Skydiving Team. He was practicing for the 2012 competition when an accident caused his paralysis. He is now a mentor for the Christopher Reeve Foundation. Lastly, Dennis Akins became paralyzed due to a trampoline accident, but that hasn’t stopped him. Dennis went on to earn a degree from Texas A&M, got a job as an engineer, and is now working for the U.S. Army Corps of Engineers.
Electromagnetic Waves at IPFW

Dr. Abdullah Eroglu, from Indiana University-Purdue University Fort Wayne (IPFW) was funded this past year for a series of workshops held for local high schools. Dr. Eroglu and a few undergraduate students were presenting demonstrations on computer aided design tools, like Matlab and electromagnetic simulators to visualize the physics fundamentals, and RFID. RFID, Radio-frequency identification, is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data, the purpose is to automatically identify and track an object. It does not require physical sight or contact between readers/ scanners and the tagged item. Dr. Eroglu and his team at IPFW use it to demonstrate fundamentals of physics and electromagnetic wave propagation. Dr. Eroglu had two sets of workshops set up, one for teachers in the fall and one for a handful of students in the spring.

During the fall sequence the teachers watched as the graduate students showed demonstrations. Throughout the workshop the teachers had to do some inventing of their own. They were asked to develop an RFID system to detect different objects using the tags. By doing this, they could see firsthand the effect of coupled electromagnetic waves between the RFID reader and the tags. Undergraduate students were a great help to Dr. Eroglu in this project, ‘they demonstrated their team skills and leadership roles by guiding teachers to conduct the experiments and have the hands on activities during the workshop’. After the fall workshop concluded, participating teachers received all workshop materials and RFID kits to carry out the same experiments in their classrooms.

During the spring sequence of the workshop, both students and teachers attended. For the students, the RFID concept was applied through a game and an experiment. Students were split into groups and assigned to design an RFID system to race two cars. The winning group was based on their RFID system. During one of the experiments, students had to use RFID systems to find objects hidden throughout the lab area. Upon completion of the workshop, teachers got to take ten RFID kits to be used in their classroom to increase student’s interest in Physics and Engineering.

At the center of our sun is the core, it’s at a excruciating temperature of 27 million degrees Fahrenheit! Within the core fusion reactions occur to produce immense amounts of energy.

Outside the core is the radiative zone, which is enclosed by the connective zone, together this makes the solar envelope. The sun’s energy begins to move by convection from the core to the outer layers of the sun.

The photosphere is what we see in emitted light. It is a thin layer of low pressure gasses that surround the solar envelope. The next layer is the chromospheres it is actually hotter than the photosphere and this trend continues out to the corona. The corona is the outermost layer of the sun and is only visible during eclipses, it is low density plasma with high transparency.
An eclipse of the Sun can only occur at the New Moon when it passes between the Earth and Sun. Due to the tilt of our moon, solar eclipses only occur about twice a year, not once a month with every New Moon. The moon’s shadow has two parts: the penumbra and umbra, which help produce the many types of solar eclipses. The penumbra is the Moon’s faint outer shadow, while the umbra is the dark inner shadow. These shadow ‘layers’ are what helps create the four types of solar eclipses. The four types of solar eclipses are Partial, Total, Annular, and Hybrid.

The next times North America is due for a Solar Eclipse are November 3, 2013 and October 23, 2014.
### 2013-2014 INSGC Funded Projects

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What started out as a small project to improve balloon launch strategies turned into a huge learning experience for two students from Valparaiso. The students, Mark and Raymond, attended four different events throughout the past year to demonstrate what all goes into a balloon launch and why it is such an important task for the community.

A lot of preparation and equipment goes into each of these balloon launches. One of the first pieces of equipment that goes into a balloon launch is a GPS and an iMet radiosonde, it transmits data back to an antenna at different MHz. The data sent to the antenna is anything from atmosphere’s temperature, humidity, pressure, wind speed, and wind direction. Attached to this equipment by a serial cable is an ozonesonde, which samples ambient atmospheric air as it rises through the troposphere and stratosphere. When the balloon reaches 110,000 feet the sampled air is pumped into a cathode chamber containing potassium iodide. In another linked cell a saturated solution of potassium iodide is being held; there is a bridge connecting them and serves as a pathway for ions. This set-up is an iodine-iodide redox electrochemical concentration. The reaction that takes place occurs in the cathode solution when O\textsubscript{3} rich air enter chamber. After a few chemical reactions occur, ions are transferred to the electrode surface in the cell chamber. So for every O\textsubscript{3} molecule, two electrons are created. The flow of electrons is what is measured to directly measure the ozone concentration in the area.

These balloons reach a diameter of about six feet before being launched! Once the balloon is launched, it takes a total of three hours for the complete flight. This balloon will reach a maximum height of 36 kilometers, although there is a good chance for the balloon to burst at such a height due to the pressure. When the balloons are descending from the atmosphere, they can land anywhere from a few to 100 miles off depending on the wind that particular day.

At workshops Mark and Raymond would allow students to help them inflate the balloon and make sure the equipment is working properly before the launch. While inflating the balloon, the two Valparaiso student would discuss ‘good’ and ‘bad’ ozone, show off the instruments and explain what they do, and then ask students to identify parts of the atmosphere. By the time Mark and Raymond finished their teaching session it would be time to countdown to the launch! From there participating students were able to help release the balloon, and then help monitor the date received from the balloon.
Unbeknownst to a lot of us, solar systems, like comets, have tails, called heliotails. An Interstellar Boundary Explorer (IBEX) has mapped out the structure of this tail, which is in the shape of a four-leaf clover. Telescopes have spotted these tails around other stars, but scientists say it was hard to determine one in our solar system.

Within the heliotail are particles that do not shine, so special equipment is needed to spot them. The technique used to ‘see’ these tails is energetic neutral atom imaging. It relies on the principle that neutral particles are not affected by a magnetic field and travel in a straight line. Thus when these particles collide with IBEX, we can get that information and calculate where the neutral particles came from, which helps describe what’s going on and what said tail looks like.

With the help of the spacecraft IBEX, a team of scientists were able to show the tail has fast and slow moving particles. On the sides there are two lobes of slow particles and the faster particles reside on the top and bottom lobes. Thus creating the four-leaf clover shape, this shape is attributed to the sun’s differing solar winds. For the last few years our sun has been sending out fast solar winds near the poles and slower ones near the equator.

Our four-leaf clover tail does not align exactly with the solar system; it’s actually rotated slightly. Scientists believe this is caused by moving farther from the sun and the magnetic field. The charged particles start to move into a new orientation because of another local galaxy. The scientists who have been working with this program are not currently aware of how long this tail is, but believe it eventually fades out into space.

Article information received from NASA website.
Last summer 40 students from high schools in the Indianapolis area participated in the IUPUI Nanotechnology Discovery Academy (INDA). This program is designed for participants to discover innovative technologies and learn about new frontiers in the STEM disciplines. INDA focuses on the growing roles of nanotechnology in medicine and renewable energy. This camp is a weeklong event divided into summer and morning sessions.

In the mornings, students attend a lecture based assembly that introduces key concepts that correlate to the labs performed by the students in the afternoon.

Along with these lectures and labs, students were invited to tour research labs, demo high end microscopy and nanofabrication equipment, and interact with faculty researchers. These activities are designed to boost interest in STEM and inspire higher education.

This program is targeting students within the Indianapolis Public School system, which is designated as high needs, but stretches across the state of Indiana as well. The summer scholars program is building an early interest in nanotechnology for future studies and career choices. Apart from the weeklong summer camp, participants are granted outlets and resources to pursue an academic relationship with faculty mentors. This allows the students to participate in independent research, compete in science competitions, and clarify college and career expectations in the STEM field.

Over the course of three years this program has impacted 200 students, and is continuing to grow. IUPUI plans on a continuation of this project, if you are interested in the program or have questions, you can contact Dr. Mangilal Agarwal at agarwal@iupui.edu.

A Lunar Eclipse can only occur at a Full Moon, and only when the moon passes through some portion of Earth’s shadow. This shadow is caused by the Earth blocking out the light and is composed of two parts: the penumbral, or outer, shadow where Earth blocks out part of the Sun’s rays and the umbral, or inner, where the Earth blocks out all sunlight. Due to these shadows there are three types of Lunar Eclipses. A Penumbral Lunar Eclipse where the moon passes only through the penumbral shadow, these eclipses are subtle and hard to observe. Then there is a Partial Lunar Eclipse, in which part of the moon passes through the umbral shadow. Lastly, there is the Total Lunar Eclipse, which the entire moon goes through the inner shadow, the moon usually appears red during this eclipse.

The next lunar eclipses to occur visible in North America are October 18, 2013 and April 15, 2014.
INSGC Newsletter...

Didn’t see your story in the newsletter? Each newsletter that comes out has a lot of work and planning involved. Not every story from the Consortium will make it to print but if you would like your story featured, send it to INSGC. A story that already has a press release or is already written up is more likely to be featured. Also, if you send us your story, even if it doesn’t make it to print it still can be published on our website www.insgc.org. Send stories to insgc@purdue.edu.

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**Industrial Affiliates**

- StratoStar Systems
- Jason Krueger

*Full contact details can be found at: [www.insgc.org]*