Tales From the Congress:
Becoming an Energy Efficient Scientific Citizen

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The second night of the Congress, one member of our NEIU SPS dispatch locked his keys in his car. A frigid Chicago wind was blowing hard that night, and Scott struggled with the coat hanger he was using to attempt to jimmy his car door open. The small crevice it was jammed through proved to be too much for him to overcome in the late hours of the night, so we each, in turn, made our own failed attempt at it. After my foray, I let the hanger dangle from the door for a few moments while I blew warm air into my hands and cursed for the umpteenth time. We all looked longingly at the keys lying on the driver's side floor mat, wondering whether we'd ever forget the 2008 Sigma Pi Sigma Quadrennial Congress. It was an event that would be burned into our memories, not only for all the fun times had and interesting people met, but also for the adversity of the road trip.

FermiLab's Wilson Hall.

After spending 30 minutes trying to jimmy it with the coat hanger and another hour failing to find an open auto parts store that offered a wedge and extension, we were in disbelief when a store clerk kindly informed us that all we had to do was call the local police, and they'd open it for us. On the way back to the hotel, I made the call. Fifteen minutes later, the officer popped the door for us, and we went back inside the hotel, defeated, to warm ourselves back up.

How many physicists does it take to open a car door? Apparently, we had so many trying to crack the problem that we missed the elegant solution.

"Mobius Strip" on the roof of Ramsey Auditorium.

FERMILAB ART AND NATURE

Thursday's trip to the Holiday Inn Select in Naperville from Northeastern Illinois University was a long Chicago commute with five eager physics majors abuzz with good conversation. We had no idea at all what was in store for us at this Congress, and with only half of us having visited FermiLab before, there

Scientists in the Sunrise at Kuhn Barn.

Friday breakfast inside Kuhn Barn.

was an air of excitement from everyone.

After checking into our hotel, we made our way to the hosting Holiday Inn and checked in for the Congress events. The first evening provided for a quaint coffee and dessert social where we became fast friends with several interesting individuals. The welcoming remarks were held in the hotel convention room and included a fascinating lecture regarding SETI and the research it's undertaking. Students and faculty from schools across the country poured into the hotel throughout the evening and into the next morning, eventually totaling more than 600. Representatives from education and industry were present even from as far away as New Zealand and Australia. Armed with instructions on how the Congress would work and last-minute changes to the schedule, we made our way back to our hotel rooms and got some much-needed sleep.

"Tractricious".

Friday morning, the NEIU SPS dispatch drove into FermiLab's campus. Approaching the security gate, we were greeted by the amazing sculpture "Broken Symmetry", built by FermiLab's founding Director Robert Rathburn Wilson. On our first drive through the campus, we would quickly learn that FermiLab had a long history of embracing art. Our gracious host provided a fantastic setting at their 6800-acre Batavia, Illinois campus.

Driving up to Wilson Hall, we crossed over the reflecting pool and passed the 32-foot high sculpture "Hyperbolic Obelisk". Approaching the Wilson Hall main entrance, in the distance we caught a glimpse of deer grazing in the 1100 acres of prairie restoration surrounded by the large Tevatron ring. We dropped Steve off at Wilson Hall Atrium for his Breakfast With the Scientists, while the rest of us drove past the Industrial Center and another Wilson sculpture, "Tractricious", on our way to the Kuhn Barn on the east side of campus. There, we enjoyed a surprisingly filling and tasty breakfast. Throughout the weekend, we

all agreed that Sigma Pi Sigma fed us extremely well: three great meals a day, with a snack or coffee break between each meal. We ate better than most students in our shoes can afford.

From Wilson Hall's 15th Floor, you can get a spectacular view of the Tevatron Ring surrounding FermiLab's prairie restoration (above) and the Reflecting Pool with the sculpture "Hyperbolic Obelisk" at the far end (right).

On Friday, we were treated to "insider" tours of the FermiLab campus, including the accelerators, the Feynman Data Center, the Grid Computing Center, the Meson Detector Building, Lederman Science Education Center, and Wilson Hall's various facilities.

While exploring the campus, we were overcome by various works of art sculptures, and paintings dotting our surroundings. The Congress even hosted an art competition on display all weekend long in the Wilson Hall Atrium. The showcase consisted of photographs, pencil & ink drawings, and painting, each produced by a Congress attendee. We were very impressed with the pieces our fellow physics enthusiasts brought for us to see. FermiLab is one of the most diverse ecological, scientific, and artistic landmarks we've ever visited.

SCIENTIFIC CITIZENSHIP

With a theme of "Scientific Citizenship" for this year's Congress, the goal was simple: connect with others, learn how to become a better scientific citizen, and help decide what action Sigma Pi Sigma and the Society of Physics Students should take to promote good scientific citizenship among non-physicists around the world. Ample time was allotted for socializing with our fellow physics enthusiasts and to learn how they practiced good scientific citizenship in their chapters, schools, professions, and everyday lives.

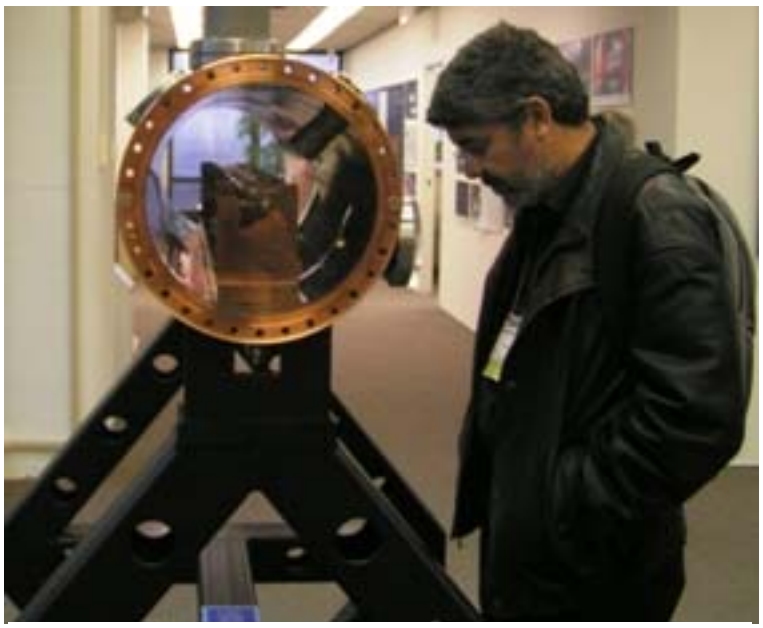
Congress attendees observing the Atrium's Foucault pendulum.

Friday and Saturday's events were organized to into workshops consisting of plenary lectures and breakout discussion groups. The lectures were given by scientists from various disciplines whose work or research promoted scientific citizenship. Ranging from public policy to SETI research, these lectures provided us with talking points and background we would take to our breakout sessions -- smaller groups of 20 each where we could constructively discuss how Sigma Pi Sigma should focus its resources.

Four workshops were scheduled throughout the Congress, and after all suggestions were submitted and tallied, we allotted two representatives from our chapter's dispatch to vote on the suggestions. While the

voting was in quite a bit of disarray (and actually did not conclude in the less-than-ample time allotted), we gained a lot from the lectures and breakout sessions. Some sessions got a little heated as we covered some very touchy political issues, but the overall format was open, inclusive, and constructive to the goals of the Congress.

The NEIU SPS dispatch was tasked with reporting on one of the four workshops. Our focus was "Energy Efficiency: Benchmarks and the Citizen's Response". This Saturday workshop consisted of two lectures. Doctors David Goldston (Director of the Harvard Energy Studies Program) and Julia Phillips (Director of the Physical, Chemical, and Nano Sciences Center at Sandia National Laboratories) treated us to informative talks on issues they hold near and dear.



Observing a segment of a primitive linear accelerator on Wilson Hall's 15th Floor.

ENERGY RESEARCH

Dr. Goldston's presentation focused on how energy policy is formed and the factors that affect it. Currently, the federal government spends about two billion dollars per year on energy research and implementation through grants and tax subsidies. He warned that energy policy is very complicated, both intellectually and practically. When science involves itself with politics, it needs to be tempered with humility, because it is very hard to change people's perceptions and habits on energy use. A small example of this is the push to use the more efficient compact fluorescent light bulbs (CFLs). Government is wary to enforce a policy through law that requires their use, due to complications in exotic waste disposal; and individuals are slow to adopt the technology when they doubt the value of the CFL or dislike the off-white light it produces.

View of Feynman Data Center from Wilson Hall's 15th Floor.

Our speaker painted a broad picture of the many economic and political factors that shape our energy policy. The energy market is mostly driven by oil prices, and interest in energy policy waxes and wanes directly with the cost of energy. Events in the Middle East during the 1970s gave rise to the oil embargo imposed by Arab-state members of OPEC (Organization of Petroleum Exporting Countries). This drove up the cost of energy in western countries, which influenced further research in bio-fuels and solar power and promoted use of more efficient vehicles. As prices subsided in the mid-1980s, research and efficiency practices were curbed by government entities and consumers, which arrested scientific advances as public awareness began focusing on other issues, such as the USSR. Today, we again are faced with high oil costs, coupled with a concern for the dangers of climate change. Although these factors seem strong enough to again spur

interest in alternative energy sources and research, Dr. Goldston cautions the consumer cannot be ignored. In fact, consumers often fail to make energy efficient decision until it is absolutely necessary, due to the expense or effort of implementation.

Much hope is seen in the incoming administration's promise of raising federal expenditures on energy research from $2 billion to $15 billion per year over the next ten years. But even this proposal has its problems. Prominent figures have suggested a grand movement akin to the Apollo Moon Missions or the Manhattan Project. But those projects were very focused on a single result and were driven by public fear. With energy, how and where do we focus our research? There are many facets we need to pay attention to: wind, solar, thermal, safe nuclear, carbon capture and sequestration, improving efficiency, and improving energy transport and storage (electrical grid, batteries, etc.). Should we put money towards applied research or theory? There is also the issue of where this money will come from in a federal budget that is already bloated. The Obama plan to raise funds is to create a carbon market by putting a cap on US industries and auctioning off the carbon credits to companies. Some politicians feel that the spike in energy prices is only temporary and the money would be better spent giving taxpayers an energy refund to help offset cost increases. Others feel that the carbon market plan shifts the costs to industry and will stifle economic development further, as well as push the costs right back on the consumer as manufacturers raise the price of their goods to offset the new costs.

After the tour of the Meson Test Facility.

EFFICIENT LIGHTING

The presentation by Dr. Phillips focused on the ability of solid-state lighting to greatly affect energy efficiency. Two technologies she is working on are light-emitting diodes (LEDs) and organic LEDs (OLEDs). She notes that an incredible 22% of total electricity use in the US is for illumination and that energy use in general will increase by a factor of two by 2050. Therefore, developing more efficient light sources will go far in curbing energy use.

Our current popular light technologies are incandescent bulbs and CFLs, which are 5% and 25% efficient, respectively. Most of that energy is lost to heat. Current solid-state lighting technology is almost 50% efficient, with promise that it may reach 70% efficiency as technology improves. This could cut energy use on lighting by a factor of two or three.

A member of FermiLab's bison herd.

LED lighting is inorganic and uses nitrides,

but manufacture is sophisticated an expensive. They have a longer lifetime than CFLs, which in turn have much longer lifetimes than incandescent bulbs. OLEDs are made of organic molecules or polymers, and can be grown (literally and figuratively) in large quantities at relatively low cost. They can be implemented directly into other materials and infrastructure, creating large-area emitters. Current manufacture technologies for OLEDs are poor, resulting in fluctuations in quality between batches and poorer lifetimes.

Congress attendees ask questions during a tour of the Grid Computing Center.

Solid-state lighting is a prime example of current research that could profit greatly from increased funding and interest, with the opportunity to improve efficiency for a large portion of current US electrical energy use.

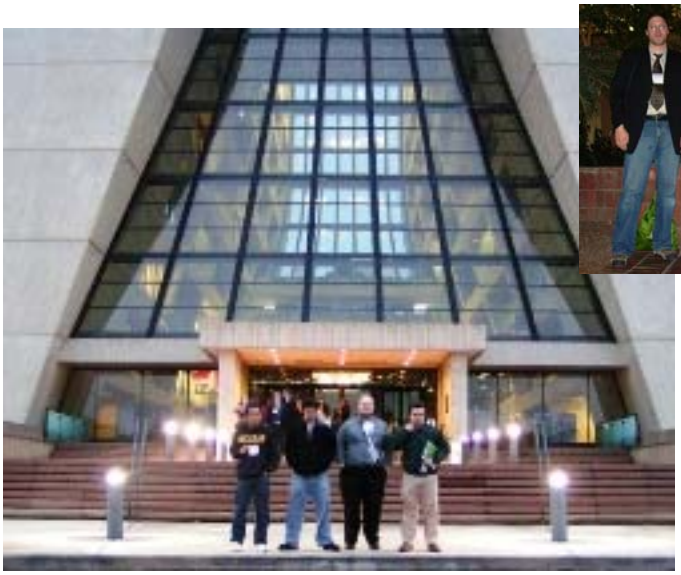
BREAKOUTS

After these two lectures, we broke out into our discussion groups. We talked about the necessity for each of us to educate ourselves in public policy so that a greater awareness of the system can help us produce meaningful change in the future. Inviting state an US government policymakers to speak at and take part in more science conferences would extend the idea of mutual education; we can learn from them as they learn from us. The SPS could also create and maintain a national database of speakers that are willing to go into universities and present their work in pubic policy and energy.

Attendees take part in breakout discussion groups.

One person from our delegation suggested that the National SPS could spearhead a research and development prize that would focus on energy efficiency. Following the format of NASA's X-Prize competitions, SPS chapters around the nation would have the opportunity to design an implement a project to produce cleaner energy or increase the efficiency of current technology. This would also encourage students to make contacts in the energy and technology industries and promote study in energy as a career goal.

Another individual pointed out that research is being done on car batteries that could have a 500-mile range. But why 500, as opposed to 100 miles, a more realistic number for most daily commuters? To reduce the cost of new car batteries, government can stoke production by transitioning their fleet to electric vehicles.



The NEIU SPS dispatch outside of Wilson Hall main entrance (left) and in front of the Atrium's Foucault pendulum (above) on the final day of the Congress.

Several of the SPS chapter representatives in our groups had participated in local outreach programs, and they brought their experiences to the talks. One idea presented was using the National SPS SOCK program to promote awareness of energy conservation. SOCK is the Student Outreach Catalyst Kit, an actual sock filled with complete physics-related projects that can be used in chapter outreach programs. SPS could fashion a SOCK project with easy-to-do energy conservation ideas that kids could take into their homes, spreading the meme of energy conservation to their parents and siblings.

The breakout sessions we participated in were filled with eager, constructive ideas. It was a pleasure taking part in these talks and developing ideas with the input of intelligent, focused individuals.

GETTING HOME

After three activity-filled days, we took our last meal in the hotel conference room. While we dined with our newfound friends, we were treated to a presentation by Nobel Laureate and former FermiLab Director Leon Lederman. The art awards ceremony followed, and one of our new friends was presented with two awards for her work in the art competition.

Pool at the hotel bar.

Post-dinner, we exchanged contact information and farewells with new associates and relaxed with a few drinks in the hotel bar. After a few friendly games of a physicist's favorite sport (pool), we were on our way back to NEIU with a late-night drive through the brisk Chicago autumn night. Exhausted and quietly reflecting about the Congress, the silent trip back was in stark contrast to the drive in and the weekend's hectic schedule. It was a truly soul-changing experience, and this year's Congress opened our eyes to how we could develop ourselves into better Scientific Citizens.