CPS Plasma Page

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Capitol Hill Audience Learns about Origins of Magnetism

Magnetic fields are everywhere in the universe. They drag matter into black holes, and they cause the sun to erupt. On our own planet, they protect us and our electronic devices from the buffeting of the sun's electrically charged wind, and they direct our compasses to point north. Galactic jets of magnetized plasma stream hundreds of thousands of light years across the cosmos, yielding extraordinary images through telescopes. Most, if not all, of the universe is permeated by magnetic fields. But when and how did the universe become magnetized?

On October 23, 2007, Professor Steve Cowley of UCLA tackled this question on Capitol Hill in a talk entitled "The Magnetic Personality of the Universe." This marked the 11th in a series of educational presentations sponsored by CPS to introduce congressional representatives and interested governmental staff to the mysteries, applications and potential future benefits of plasmas.

After being introduced by CPS Chair Lee Berry, Prof. Cowley presented a number of astrophysical examples of how plasmas and magnetic fields exist together in the universe, and discussed the theories that have been proposed to explain the origins of these fields. Did magnetic fields form before the structure of the galaxy, or did they form simultaneously? Or did magnetic fields appear after galaxies were formed?

One theory holds that magnetic fields are created from black holes in the center of galaxies. In a black hole, plasma whirls into the hole like water going down a drain, gaining energy as it rotates and heating up to trillions of degrees. It is theorized that in the process it generates a magnetic field. Radio telescopes make it possible to observe in Radio Galaxy 3C296, jets of plasma and magnetic fields being ejected from a black hole at the galaxy's center.

Prof. Steve Cowley discusses his presentation with guests. Photo by Paul Rivenberg

Cowley spent time detailing examples of plasmas and magnetic fields in the universe, including galaxy clusters, plasma arcs on the surface of the sun, and the polar lights, before focusing on an experiment at the University of Wisconsin using the Madison Symmetric Torus. Researchers there are looking at ways of stirring the plasma to create its own magnetic field.

Prof. Cowley concluded that we still do not know when, where or how the universe became magnetized, but with the advent of supercomputers and radio telescopes this field of study is opening up to fresh exploration. There are still many questions to answer or contemplate. Is the magnetic field organized just in little patches throughout the universe, or is there a magnetic structure on a grand scale that comprises the entire universe? The challenge to plasma science is to better understand the complex dynamics of the plasma and magnetic fields; the challenge to astrophysics is to understand how that dynamic shapes the objects we see.

Plasma Postage: U.S. Postal Service Issues Aurora Stamps

On October 1, a new series of U.S. postage stamps was dedicated, meant to draw attention to the global role of polar scientific research, and featuring plasma.

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The two 41-cent Polar Lights stamps feature the aurora borealis and the aurora australis, or the northern and southern lights. Today, the polar auroras are being studied as part of the International Polar Year, a multinational research program that will focus on the Arctic and Antarctic until March 2009.

The press release about the postage stamp takes the opportunity to provide some scientific background about the plasma phenomenon: "During magnetic storms, energetic electrons descend from space and collide with molecules in the upper atmosphere, leading to the emission of green and sometimes red light. Auroras come in different visual forms, including arcs, curtains and rays, and are a relatively common sight in Alaska, Canada and northern Europe." To read the entire press release go to: http://www.usps.com/communications/newsroom/2007/sr07_040.htm

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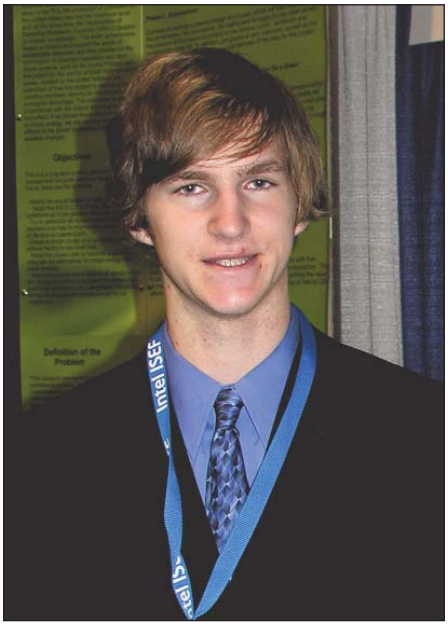
Plasma Science Wins Big at Intel Science & Engineering Fair

Albuquerque, NM - Sometimes the second time is the charm. At least this was the case for Carl A. Turner, a finalist for last year's CPS Excellence in Plasma Science Award, and this year's winner. The award of $1000 has been presented for the past three years as part of the Intel Science & Engineering Fair. Turner's project was also honored by Intel's Electrical and Mechanical Engineering Third Award ($1000).

Carl's project, "An Optical Sensor to Assess High Intensity Discharge Lamp Age Through Spectral Analysis," is an expansion of the same project he worked on last year. Carl developed a field test instrument that will predict when a high pressure street lamp is about to fail and needs replacement. Judges Lee Berry (ORNL) and Steve Allen (LLNL) noted that since last year Carl had improved the accuracy of the device by a factor of five, adding a Global Positioning System tag to the data, and measuring the actual spectra at the University of Minnesota.

Carl's improvements to the device would allow lamps to be replaced systematically before failure, eliminating expensive replacement calls. A prototype has been developed, a patent application submitted, and field testing scheduled for this summer. When asked what he liked



Carl A. Turner, 18, Senior, New Prague Senior High School, New Prague, Minnesota,

least about his project, Carl said it was the patent application process.

The judges were happy to see last year's winner, Sarah Lynn McCuskee, still working on plasma-related issues. This time it was "Lightning in the Laboratory: Electromagnetic Radiation from Red Sprites." She was one of the four finalists for the CPS prize. The excellence of her project was also acknowledged in Intel's Physics and Astronomy category, with a Fourth Award of $500.

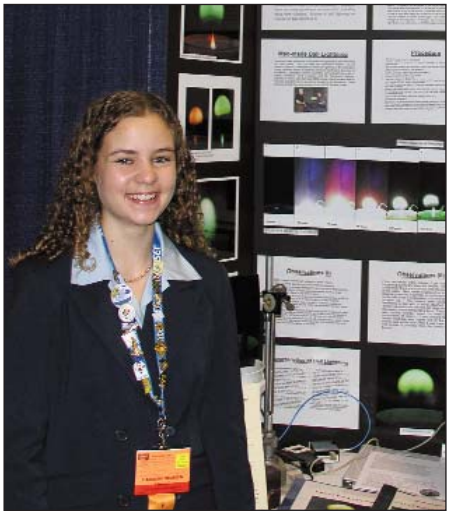
Another CPS finalist also did a project on lightning: "Great Balls of Fire." Caroline von Wurden focussed her project on ball lightning, winning the Physics and Astronomy Second Award of $1500. She also received a tuition scholarship award ($8000) from the Office of Naval Research on behalf of the United States Navy and Marine Corps.

The remaining finalist was Thiago Olson, for his project, "Neutron Activation Analysis Using an Inertial Electrostatic Confinement Fusion Reactor." He was awarded Intel's Physics and Astronomy Second Award of $1500, as well as the First Award from the American Association of Physics Teachers and the American Physical Society.

Perhaps the third time is also the charm for plasma science and application projects. Judge and CPS Chair Lee Berry notes that "The number of plasma projects has increased every year since the plasma prize was started at the 2005 ISEF in Phoenix. Hopefully the CPS prize has played a role in the increase. We will be increasing the award next year to $1500. We look forward to honoring future students for their scientific achievements."

Sarah Lynn McCuskee, 15, Sophomore, Campbell Collegiate, Regina, Saskatchewan, Canada
Project: "Lightning in the Laboratory: Electromagnetic Radiation from Red Sprites"

Thiago David Olson, 17, Senior, Stoney Creek High School, Rochester Hills, Michigan
Project: "Neutron Activation Analysis Using an Inertial Electrostatic Confinement Fusion Reactor"



Caroline Julia von Wurden, 15, Sophomore, Los Alamos High School, Los Alamos, New Mexico
Project: "Great Balls of Fire"

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