CPS Plasma Page

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David Graves Details Plasma's Power to Prevent Infection

Washington, DC – On March 28, 2012, the Coalition for Plasma Science presented the 17th in a series of educational talks to members of Congress and their staffs. In a talk entitled "Plasma Power: Battling Contagion Using Electricity and Air," Prof. David Graves of U.C. Berkeley provided a compelling argument for using plasma as a means of combating infectious disease.

After reviewing the broad range of temperatures used in plasma applications, from the very hot ionized gas involved in fusion research to the relatively low temperature plasmas used in plasma etching of computer chips, Prof. Graves detailed the growing threat of infectious disease. Our ability to move people and food – along with microbes – quickly across the globe; the rise of large cities, often with limited public health facilities; changes in climate that disrupt ecosystems; the emerging threat of bioterrorism; the rise of antibiotic resistance – all increase the potential for exposure to infectious, life-threatening disease.

Prof. Graves spent time explaining the challenge of "Hospital-Acquired Infections" (HAIs), which in 2002 were responsible for 99,000 deaths in the U.S. Patients can be exposed to disease via improper staff hand hygiene, catheter-associated urinary tract infections, catheter-related bloodstream infections, surgical site infections, ventilator-associated pneumonia, and transmissible spongiform encephalopathies (TSEs), like prions. With the number of antimicrobial drugs decreasing while drug-resistant bacteria increase, nonthermal plasmas can help protect patients from infection. They do this by generating chemical species that are created naturally by plant and animal autoimmune systems – Reactive Oxygen and Nitrogen Species (RONS).

David Graves engages Chris King, (left - Committee on Science, Space and Technology) and Bill Bonvillian (Director of the Massachusetts Institute of Technology Washington DC Office) in a discussion about the value of plasmas for disinfection. Photo/Paul Rivenberg.

The fact that RONS have been part of immune systems for billions of years suggests that resistance development is not a long-term threat. Prof. Graves asserted that this is just one of the reasons plasma devices have an advantage over disinfection chemicals. Plasma devices can be made handheld or scaled to large areas; they need only electricity, which would be an advantage during pandemics, or in remote locations and countries with limited resources; they can be easily automated (e.g., integrated with catheters, bandages or surfaces); they can disinfect water, and synergize with UV; finally, the technology is inexpensive.

Prof. Graves's engaging presentation prompted many of those attending to comment and ask questions long after the scheduled close of the talk.

Exploring Plasma Projects at the Intel International Science and Engineering Fair

Pittsburg, PA – For the eighth year in a row, the Coalition for Plasma Science presented its Excellence in Plasma Physics Award at the Intel International Science and Engineering Fair. From over 1500 precollege students competing, CPS Chair Lee Berry discovered 15 that explored the topic of plasma. The prize of $1500 was given to Shannon Wetzler of Kings Park High School in Kings Park, NY for her project **"The Novel Determination of the Stopping Power and Other Characteristics of Quark-Gluon Plasma Based on Several Jet Modification Measurements."**

Shannon Wetzler's project is based on data from Brookhaven National Laboratory, where their Relativistic Heavy Ion Collider (RHIC) accelerates trillions of "gold ions" in opposite directions around a 2.4 mile circular track. Those ions that smash into each other and explode can generate enough heat to create a tiny amount of quark-gluon plasma for only a tiny fraction of a second. Understanding the behavior of this ephemeral matter can provide insights into the universe immediately after the Big Bang.

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Shannon Wetzler stands in front of the posters describing her study of quark-gluon plasma. Photo/ Lee Berry

According to Lee, Shannon patiently explained how her analysis suggested that the quark-gluon plasma has characteristics of both a 'strongly coupled' plasma and of a 'weakly coupled' plasma. Her equally patient description of the difference between weakly and strongly coupled plasmas emphasized the stronger role of Debye shielding in weakly coupled systems.

Beside the CPS Special Award, Wetzler received an INTEL Grand Award – a so-called "Third Award" of $1000 in the Physics and Astronomy category. Six other plasma projects were recognized with Special and/or Grand Awards.

Unidirectionalization of Particulate Distributions in Isotropic D+D -> He3+n Reactions Utilizing Differential Ion Velocities: Benjamin Bartlett, Lexington High School, Lexington, SC.

Intel Physics and Astronomy Fourth Award ($500); European Organization for Nuclear Research – CERN (awarded an all-expense trip to tour CERN).

The Development of Low Voltage, Solid-State Plasma Focus Devices for Portable Radiation Sources: Adam Bowman, Montgomery Bell Academy, Nashville, TN.

Intel Physics and Astronomy Fourth Award ($500); Air Force Research Laboratory First Award ($3000); Vacuum Technology Division of the American Vacuum Society Second Award ($500); Office of Naval Research on behalf of U.S. Navy and Marine Corps Tuition Scholarship Award ($8000).

The Use of an Inertial Electrostatic Confinement Fusion Reactor in Medical Treatment and Imaging: William Jack, Hudson High School, Hudson, OH.

International Council on Systems Engineering Second Award ($500); Office of Naval Research on behalf of the U.S. Navy and Marine Corps Tuition Scholarship Award ($8000).

Deuterium Fusion Using Inertial Electrostatic Confinement: Michael Kovalchick, Dallastown Area High School, Dallastown, PA.

Intel Physics and Astronomy Fourth Award ($500)

Amateur Laser Physics: Engineering Affordable Gas Lasers to Discover What Affects Output Power: Joseph Lee, Saint Peter's Academy, New Market, AL.

Intel Physics and Astronomy Fourth Award ($500)

The Removal of Harmful Contaminants in Water Using Low Temperature Microplasma: Mervy Atif Michael, Union City High School / Academy for Enrichment and Advancement, Union City, NJ.

Intel Environmental Sciences Fourth Award ($500); Air Force Research Laboratory on behalf of the U.S. Air Force First Award ($3000)

"Each year, special award organizations recognize selected young scientists during the Intel International Science and Engineering Fair. We congratulate these winners. Participating in events such as this competition requires drive and curiosity that will lead these students in the quest for answers to significant scientific questions," said Elizabeth Marincola, president of Society for Science & the Public.

Each year more than 1,500 high school students from about 70 countries, regions, and territories display their independent research at the Intel ISEF. Photo/Lee Berry