

CPS Plasma Page

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Sir Chris Llewellyn Smith Goes to Washington

At a CPS Capitol Hill Educational Luncheon on October 11, 2005, Sir Chris Llewellyn Smith provided a case for moving aggressively towards plasma fusion energy in a talk entitled "A Fast Track Approach to Fusion Energy." The speaker is Director of UKAEA Culham, which houses the Joint European Torus (JET), currently the world's largest fusion research facility.

Llewellyn Smith reviewed the basics of fusion, focusing on magnetic confinement traditionally explored in tokamaks and laying the groundwork for a discussion of the International Thermonuclear Experimental Reactor (ITER), an international project that aims to demonstrate physics and engineering on the scale of a power plant.

The speaker focussed on challenges to creating fusion energy. The challenge of making an effective magnetic bottle, he said, has largely been met, though improvements continue to be made. Still, the fusion community needs to create a "robust" container, one made of materials

that can stand up to the damaging potential of super-hot plasma fuel. It also needs to make a system that is reliable, one that can generate its own tritium fuel, since (unlike deuterium, which is present in water) tritium is not plentiful. He suggested that lithium could be used to convert the neutrons from a deuterium-tritium reaction into tritium + helium.

Llewellyn Smith listed the advantages of a fusion power plant: an unlimited source of fuel; no carbon dioxide or air pollution; and no possibility of a major accident. The major disadvantage is the radioactivity that would be left in the blanket surrounding the tokamak after many years' use. But this is not considered a long-term waste burden.

The speaker concluded with a recipe for a fast track to fusion power. He suggested that during ITER construction the U.S. should continue to operate its current fusion devices to speed up and improve ITER operation. He strongly advised that, in tandem with ITER,



Sir Chris makes the case for pursuing plasma fusion aggressively. Photo by Paul Rivenberg

countries create an International Fusion Materials Irradiation Facility (IFMIF) to explore materials that can withstand high radiation for use around the tokamak. Finally he suggested starting work early on parts of a prototype power plant (DEMO), making adjustments as we learn more.

About 50 members of Fusion Power Associates, who were in Washington, DC for an annual meeting, also attended the talk.

What Next? CPS Prioritizes

In mid-August, CPS Steering Committee members met for a day-long retreat at the Massachusetts Institute of Technology Plasma Science and Fusion Center to prioritize activities for 2005 - 06. During this productive day a number of projects were proposed, many of which could draw new and existing CPS members to become more involved. Please look over the proposals below to see if any might be of interest.

Science demonstrations for teachers: We would like to create an area on the CPS education website where we could list and describe new plasma-related demonstrations for teachers. To discover and create these demonstrations we are considering

having a contest to see who can create the best demonstration (web-based or in-class). We are seeking an individual who can take the lead on this project.

Changing federal and state educational standards to include plasmas: During planning for the 04 APS-DPP meeting in Savannah, CPS members worked successfully on having plasmas integrated into the required science curriculum standards, which were about to be revised. More science standards are out there requiring knowledge of only three states of matter. Which state standards are incomplete, and how can we get them to include plasmas? We need a leader for this effort.

Continuing projects: Retreat participants

agreed that some ongoing CPS projects have been so successful they deserve continued and increasing support. These include INTEL Science Fair participation, particularly with regard to providing judges from the plasma community; continued development of "About Plasmas" our technical two-pagers; and further support for Capitol Hill Educational Seminars.

With all these goals and priorities, the question of funding inevitably arises. How do we pay for these worthwhile efforts? Members discussed soliciting funds from current members, or establishing yearly dues, as well as finding new members to support this work.

Plasmas in the Night Sky: Auroras Light Up CPS Congressional Luncheon

On May 16, 2005, the Coalition for Plasma Science hosted the seventh in its series of Congressional Luncheons, this time on the topic of the Aurora Borealis. Popular educator Prof. David Newman, from the University of Alaska Fairbanks, supplemented his discussion of the science behind the phenomenon with his own personal experiences observing the aurora in the skies of his Alaska home.

Newman revealed the connection



Dave Newman uses a plasma to blow a cork from a bottle. Photo by Paul Rivenberg

between activity on the sun and the aurora, which is the effect of particles from the sun hitting the ionosphere. Solar storms will create spectacular auroral displays. Newman noted that the morning news had reported some recent solar activity that was going to affect communications that day.

From here Newman launched into a definition of plasma, providing examples both man-made and natural, including stars, interstellar space, the solar wind and fluorescent lights. He described the aurora as a “giant neon light” in the sky. He also used the occasion to discuss the fusion process in relation to the sun, and as a possible future source of energy on earth.

Although beautiful, the effects of the aurora can be problematic. Plasmas and their radiation can interfere with commu-



The invited audience observed a plasma through spectrographic eyewear supplied by CPS. Photo by Paul Rivenberg

nications, and even damage communication satellites. A solar storm can also heat up and expand the atmosphere so that it creates a drag on a satellite. Newman discussed some new communications experiments that involve the ionosphere.

CPS Chairman, Lee Berry started the luncheon by highlighting some of the organization’s recent outreach activities, particularly the Intel International Science and Engineering Fair award.

Intel International Science & Engineering Fair: CPS Judges Honor Two Students

When CPS Chair Lee Berry decided to spearhead the Coalition’s proposal to sponsor a Plasma Science prize at the Intel International Science & Engineering Fair (ISEF), he had no idea he would have so much fun. Berry reports that it was a treat to review student projects, select those that fit CPS criteria, and judge the entries.

He had good help. Also judging plasma projects were: **Frank Jansen**, Vice President of Technology and Engineering, BOC Edwards North America; **Tom Licata**, Director of Marketing, Tokyo Electron America, Inc.; and **Steve Allen**, Staff Member Lawrence Livermore National Laboratory. Tom and Frank were identified by the IEEE Committee on Plasma Science and Applications as judge candidates while Steve came from the APS Division of Plasma Physics.

Taking place in Phoenix, Arizona during the week of May 8 - 13, this event annually presents more than 900 individual and team awards in categories ranging from Behavioral and Social Sciences to Zoology. This year, for the first time, CPS offered a cash award of \$1000 to the student with the best presentation related to the topic of plasma science or applications.

The CPS judges found two projects to be good enough to share the prize. Joshua Klein, of Catholic High School in Huntsville, AL, won for his project, “A Non-Intrusive Investigation of a Simulated Ball Lightning Phenomenon in My Microwave Oven,” which studied plasmoid creation in a microwave oven. His abstract notes, “After the data was processed, the hottest plasmoid temperature was found to be above 4000 Kelvins.... Considering the temperature of the sun’s surface is somewhere between 5500 and 6000 Kelvins, I was amazed that I could even come close to producing a similar value in my microwave oven.”

Joshua shared the prize with Thomas Trudel of Muhlenberg High School in Reading, PA, for his project: “Ion Thruster Development and Analysis,” which entailed designing, constructing and testing a functional RF ion propulsion system, in order “to compare different gas flow arrangements.” Joshua compared the efficiency of ion production using a traditional straight feed delivery nozzle vs. a novel spiral feed gas flow sys-



CPS Chair Lee Berry (center) helped judge the plasma-related science projects at the Fair. He stands with winners Joshua Klein (right) and Thomas Trudel.

tem. The conclusion? “The spiral gas flow produced substantially higher ion density levels than the traditional design.... (This system) could have considerable significance in improving thruster efficiency and extending fuel reserves for space applications of RF ion thrusters.”

Lee Berry is presenting an educational poster about the ISEF for CPS during the American Physics Society Division of Plasma Physics annual meeting, October 25 in Denver. CPS is looking for volunteers to judge plasma projects at next year’s ISEF in Indianapolis, Indiana.