Physicists gather in Denver for world's largest annual plasma conference

October 23 2005

Most of the matter we are familiar with in everyday life comes in three states - solid, liquid, or gas. But much more of the matter in the universe exists in a fourth state known as plasma.

Plasmas are gaseous collections of electrically charged particles such as electrons and protons. Stars are primarily composed of hot plasmas. On Earth, plasmas are formed in lightning strikes and produce light in fluorescent bulbs. They are used to inscribe patterns in computer chips and other electronics, and are at the heart of the most promising nuclear fusion devices that may someday lead to an abundance of cheap, clean, and safe power sources.

These and many other subjects will be addressed at the 47th Annual Meeting of the American Physical Society's Division of Plasma Physics, to be held October 24-28, 2005, at the Colorado Convention Center in Denver. More than 1500 attendees will present 1600 papers covering the latest advances in plasma-based research and technology.

Here are some of the highlights of the meeting:

APS-DPP INVITES DENVER PUBLIC TO - PLAY WITH PLASMA - AT PLASMA SCIENCE EXPO
October 27, 6:00-8:00PM

We live on a planet where we are surrounded mainly by matter in the familiar states of solid, liquid, and gas. Though many of us are not aware of a fourth state of matter, in Denver that is about to change. The American Physical Society'TMs Division of Plasma Physics (APS-DPP) has scheduled a series of educational events to encourage teachers, students and the general public to explore plasma.

Scientists from around the country and the world will guide visitors as they create arcs of lightning, observe their fluctuating body temperatures on a special monitor, manipulate a glowing plasma with magnets, and learn how to confine a plasma by playing a fusion reactor video game. Students at all levels, teachers, parents and the general public are welcome.

The Expo is free-of-charge.

STUDYING TURBULENCE WITH A PLANETARY-SCALE WIND TUNNEL
October 24, 2005
Monday, 11:00-11:30 am
Invited Session BI1: Space and Astrophysical Plasmas I
Adam's Mark Hotel - Plaza Ballroom ABC

Researchers at Los Alamos National Laboratory are using the solar wind and the Earth's magnetosphere as a planet-sized 'œwind tunnel'? to study the flow of plasma, much as engineers use wind tunnels to study airflow when designing aircraft. A recent study has shown that turbulence in the solar wind affects the way the wind interacts with the Earth's magnetosphere, just as turbulence in the air affects airflow around an aircraft. This research is important if astronomers are to understand the large-scale flows of plasma throughout the universe.

HIGH SPEED IMAGES CAPTURE RIPPLES IN EDGE OF HOT PLASMA
October 24, 2005

Monday, 2:00 pm
Session CP1: Poster Session II
Adam's Mark Hotel - Grand Ballroom I & II

Physicists have opened a new window into the complex behavior that occurs at the edge of a 100 million-degree fusion plasma, of the type that will be produced in some fusion reactors. Using advanced high-speed cameras, physicists obtained very detailed, three-dimensional images of plasma instabilities known as Edge Localized Modes (ELMs). Additional images also provided researchers with their first glimpse of how particles and energy are transported during an ELM instability, which can hamper a reactor'TMs operation

Until recently, the inability to make sufficiently high resolution measurements has stifled efforts to fully characterize these mechanisms. The images captured by researchers on the DIII-D Tokamak, a prototype fusion reactor at General Atomics in La Jolla, California, have led to a much better understanding of ELM instabilities, with several theoretical predictions verified by these measurements. The work is an important step toward construction of fusion-based power production.

DYNAMO PROVIDES CLUES TO ORIGIN OF PLANTARY AND GALACTIC MAGNETIC FIELDS *This paper is embargoed until October 24, 2005*
October 24, 2005
Monday, 9:30-10:00 am
Invited Session BI2: Basic Plasma Physics I
Adam's Mark Hotel - Plaza Ballroom EF

Research on the Madison Dynamo Experiment at the University of Wisconsin-Madison is revealing new insights into the behavior of the magnetic fields generated by the Earth and other rotating objects, including planets, stars, and galaxies.

The experiment uses a spherical vessel that holds a cubic meter of molten sodium. Propellers in the vessel drive flows of the sodium and create conditions necessary to generate a magnetic field in a similar manner to molten cores that generate fields surrounding the Earth and Sun.

The study yields experimental data on a range of magnetic-field generating systems'"from entire galaxies and stars to the Earth and other planets'"that scientists previously could only observe and model.

ACCELERATING ELECTRONS WITH BRIGHT SPARKS
October 25, 2005
Tuesday, 11:30 - 12:00 pm
Invited Session FI2: Plasma-Based Acceleration and Light Sources
Adam's Mark Hotel - Plaza Ballroom EF

Scientists at the University of Texas have discovered a new method to amplify and compress laser power. The researchers directed two laser beams, with slightly different frequencies but traveling in the same direction, into a series of plasmas, eventually creating sparks that produce plasma wave "buckets." The buckets grab and accelerate low-energy electrons up to hundreds of millions of electron volts.

If this method is proven in experiments, the technique could lead to tabletop electron accelerators for portable X-ray sources in medical applications or for gamma-ray radiography of tiny objects.

UP AGAINST THE WALL SOLID AND LIQUID SOLUTIONS TO FUSION'TMS MATERIAL CHALLENGES
October 25, 2005
Tuesday, 10:30 - 11:00 am
Invited Session FI1: The Road to Burning Plasmas
Adam's Mark Hotel - Plaza Ballroom ABC

October 27, 2005
Thursday, 2:00 pm
Session RP1: Poster Session VIII
Adam's Mark Hotel - Grand Ballroom I & II

Experiments at the Massachusetts Institute of Technology and Princeton University have demonstrated novel approaches to designing effective containment walls for fusion reactors. The new methods, coating wall materials with an ultra-thin layer of boron and using liquid metal lithium as a wall material, have important implications for the design of fusion reactors.

When subjected to heat loads greater than those expected in a fusion reactor, the lithium liquefied and began to swirl rapidly, distributing the heat in much in the same way stirring makes all of the soup in a pot reach the same temperature. The 'œself-stirring'? of the lithium observed in the Lithium Tokamak Experiment (LTX) at the U.S. Department of Energy'TMs Princeton Plasma Physics Laboratory suggests a simple and efficient technique for heat dissipation without the use of expensive pumps and complex plumbing. It is a new concept that has potential to solve the heat load challenge in fusion reactors and other high heat load environments, such as 'dumps' for high intensity beams.

KEEPING THE FIRE BURNING IN A FUSION REACTOR
October 27, 2005
Thursday, 11:30 - 12:30 pm
Invited Session QI1: Wave and Particle Interactions
Adam's Mark Hotel - Plaza Ballroom ABC

In research with important implications for the development of the International Thermonuclear Experimental Reactor, recent experiments on the DIII-D fusion facility at General Atomics in La Jolla, California, and on the National Spherical Torus Experiment (NSTX) at the

Princeton Plasma Physics Laboratory in Princeton, New Jersey, have simulated the behavior of alpha particles and AlfvÃ©n waves expected in the plasma of a fusion reactor.

NSTX and DIII-D researchers can now address whether super AlfvÃ©nic ions interacting with short-scale AlfvÃ©n waves can lead to loss of energetic particles in ITER and how these AlfvÃ©n waves might affect thermal plasma particles.

For more information on the conference, visit the APS-DPP virtual pressroom at www.aps.org/meet/DPP05/baps/vpr.cfm

Source: American Physical Society