Physical Sciences

Dietrick E. Thomsen reports from New Orleans at the meeting of the Division of Plasma Physics of the American Physical Society

Russian advice on long-wave lasers

Laser fusion, or inertial-confinement fusion, is an attempt to generate nuclear fusion in a target pellet that is compressed and heated in an implosion triggered by beams of laser light hitting the target. Since such efforts began, physicists have debated the relative merits of long-wave versus short-wave lasers. Long-wave lasers, which are gas or liquid, are more efficient and can be fired with rapid repetition, but their light does not deliver energy well to the target. A lot of its energy goes to heating electrons, which do not contribute much to the implosion. Short-wave lasers avoid this electron preheating, but they are less efficient and, being made of glass, have to cool between firings and so have very slow repetition rates.

In a post-deadline paper, S. Yu. Gus'kov of the Levedev Physical Institute in Moscow presented a theoretical analysis by himself, N. G. Basov (SN: 11/26/77, p. 361), V. B. Rozanov, S. A. Shumsky and V. V. Zverev purporting to show that for targets of the size and shape that reactors would be likely to use, the electron preheating problem is less serious than the participants in the debate had previously assumed. The paper concludes that there is "a possibility to consider long-wave lasers and, particularly, the most advanced CO_2 laser to be the candidates for the application in the energy reactor based on laser fusion."

The paper drew the attention of a number of Americans prominent in the field, who seemed to divide along party lines. People from Los Alamos National Laboratory, which has concentrated on long-wave lasers, were asking Gus'kov whether he would come to Los Alamos for further discussions. (He couldn't, due to difficulties with airline schedules, he said.) Those from the Lawrence Livermore National Laboratory, which has concentrated on short-wave lasers, were more skeptical. John Nuckolls of Livermore asked detailed and critical questions. People were impressed, however, that the Russians would send such a paper to an American national meeting rather than an international forum.

Tokamaks: We are driven

The other major approach to controlled nuclear fusion is to confine the fuel, which is a plasma or ionized gas, in a magnetic field and heat it. This is a very difficult thing to do, and the history of the attempt is long, tortured and frustrating, but one of the most promising current approaches is the torus-shaped device called a tokamak. (The word tokamak is made up of the first syllables of the Russian words for "toroidal magnetic chamber.")

An advantage claimed for tokamaks is that the confining magnetic fields induce an electric current that flows in the plasma around the ring of the torus. Resistance to this current confines the plasma.

In practice this "ohmic" current does not heat the plasma enough. Furthermore, the current decays away by self-induction and so the tokamak operates in pulses or spurts. Alternatives have been sought, and two successes at driving a current in the plasma by introducing radio waves from outside were reported: in the Princeton Large Torus by Stefan Bernabei of Princeton University and in the Alcator C by Jack J. Schuss of the Massachusetts Institute of Technology.

The driven current gives a prospect of better heating and also a steadily operating tokamak instead of a pulsed one. There are important engineering and economic advantages to such a steady-state tokamak.

Bernabei's presentation elicited a spirited discussion of whether the method can be extrapolated to a reactor-sized device given that radio waves require lots of power. The response is: not in present form, but a variant approach might work. As the session chairman, John E. Scharer of the University of Wisconsin pointed out, "Plasma physics moves in steps. This is a significant step."

Biomedicine

Trenchmouth and stress

A strong relationship between stress and trenchmouth — a bacterial infection of the gums characterized by gum bleeding, gum pain and foul breath — has been demonstrated for the first time in a study, reports Ronald B. Cogen of the University of Alabama School of Dentistry in Birmingham and colleagues. Stress appears to cause trenchmouth by increasing levels of the adrenal hormone cortisol in the body. This increase impairs the ability of a type of immune system cell to dispose of harmful bacteria, Cogen and his team found.

Cogen studied 100 trenchmouth patients. Compared with controls matched by race, age, sex, socioeconomic status and plaque accumulation on the teeth, trenchmouth sufferers showed significantly more anxiety, reported more negative recent life events that affected them to a greater perceived degree, were significantly more depressed and suffered from a significantly greater number of emotional disorders. The trenchmouth patients were also examined for levels of various hormones. Only the adrenal hormone cortisol was increased. Adrenal hormones increase in the body in reaction to stress and depress the body's immune system. White cells in the patients were also studied because white cells make up a substantial part of the body's immune system. The levels of various kinds of white cells were within normal levels in the patients. But the patients were found to possess impaired polymorphonuclear leukocytes — white cells known to engulf and eliminate bacteria.

The study also produced an unexpected finding: blacks appear to be virtually unaffected by trenchmouth. Only one of the 100 study patients was black, yet all came from a university dental clinic population that was 40 percent black.

A magnetic necklace for neck pain

Several years ago a Japanese scientist reported that a necklace containing a static magnetic field with a magnetic flux density of 1300 gauss could relieve chronic neck and shoulder pain. However, he did not demonstrate such an effect with a controlled clinical trial, nor did he demonstrate physiologically how the necklace might relieve pain. Chang-Zern Hong and his team at the Rehabilitation Institute in Detroit set out to do both.

As they report in the October ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION, they were not able to show that the necklace relieves neck and shoulder pain. But they were able to show that it influences the conduction of a nerve in the arm, suggesting that more research might demonstrate that the necklace can relieve neck and shoulder pain.

Petition to ban metabisulfites in drugs

Besides asking that the Food and Drug Administration rescind metabisulfites' designation as food additives "generally recognized as safe" (SN: 11/6/82, p., 294), the Center for Science in the Public Interest has petitioned the FDA to ban use of these chemicals in prescription drugs — especially those used by asthmatics. Some patients have developed the same life-threatening sensitivities from drugs containing metabisulfites as have been reported among asthmatics exposed to these chemicals in food.

In its petition, CSPI noted a 1977 report by Frank Twarog at an American Academy of Allergists meeting describing immediate hypersensitivity traceable to a preservative — sodium bisulfite — used in the asthma remedy Bronkosol. And at a meeting of the same organization last year, two Australian physicians reported similar asthmatic reactions to the preservative sodium metabisulfite among patients who had used Decadron (a drug to relieve inflammation) or used a drug called Maxalon.

FDA spokesperson Faye Peterson said the agency has no records of adverse effects from metabisulfites in asthma drugs, but that based on CSPI's petition FDA will look into the issue.

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