

EXCLUSIVE

SCIENCE AND TECHNOLOGY

Major Fusion Breakthroughs Reported

Scientists from throughout the world detailed major progress in all facets of fusion energy research at the annual meeting of the American Physical Society's Plasma Physics Division in Atlanta, Georgia last week.

SPECIAL REPORT

The more than 2,000 attendees represented virtually every country and laboratory engaged in fusion and plasma physics research in the world.

The overwhelming consensus of the major review papers presented, together with the more than 2,000 regular papers represented on, was that almost every approach to harnessing the vast potentials of fusion energy is making significant progress, and many can confidently be projected to be capable of leading to economical power reactors — the chief impediment being the lack of funds.

At the same time, presentations by Drs. Harold Grad and Fred Tappert of the Courant Institute of Mathematics, among others, outlined the new scientific frontiers which are being charted in the course of fusion and related plasma physics research. Dr. Tappert, in his invited presentation, outlined the revolution which is being generated in science as a whole by research on nonlinear phenomena and in particular the soliton.

Laser and Electron Beam Pellet Fusion

The most dramatic progress was reported in the development of inertial confinement fusion which utilizes intense beams of lasers, electrons, or ions — and now, as it turns out, BB's.

The most important presentation was given by Dr. John Nuckolls, leading fusion theoretician of the U.S. Livermore Laboratory. Dr. Nuckolls gave a detailed overview of the progress in inertial fusion made over the last year. He demonstrated that all of the major scientific and technological problems of harnessing inertial fusion energy had in effect been solved:

* Experimental results both here in the U.S. and USSR, based on these models and already achieved experimental results, indicate that fusion energy gains greater than a thousand are obtainable. This means that the chief type of laser currently utilized in inertial fusion experiments, the very inefficient neodymium glass lasers, can be used in actual laser fusion power plants. (Livermore has already carried out initial tests on the upgrading needed to make this laser amenable for reactor use.)

* New laser fusion reactor designs have essentially solved all of the technical problems: no radioactive

waste generated; life-times greater than 30 years.

* The prospects for ion, electron, and laser fusion utilizing carbon dioxide gas lasers is similarly optimistic.

* A promising new approach to inertial confinement has been developed utilizing small BB's which are accelerated to great speeds electromagnetically to crush fusion pellets to the needed densities and temperatures.

Dr. Nuckolls concluded by pointing out that the chief barrier to harnessing laser fusion energy was the lack of funds and national commitment. For example, Livermore has the world's most powerful laser, Shiva, coming on line early next year. This \$40 million laser will experimentally demonstrate the new high gain pellet designs, but due to funding cutbacks by the Carter Administration, there are insufficient operating funds to make full use of the laser.

Throughout his presentation, Dr. Nuckolls directed a scathing rebuke to the notorious Fabian anti-nuclear nuclear engineer David Rose of the Massachusetts Institute of Technology. Rose had published a slanderous attack on fusion energy and laser fusion in particular last year in the student journal, MIT's Technology Review. This article was circulated to members of the U.S. Congress during the debates on fusion funding during the past period. In referring to Rose, Nuckolls commented at one point that one should not make final statements about a subject while others are still engaged in their exploration. "We have solved all of the difficulties in the last year which Rose had foreseen as insurmountable."

(This writer learned later that Rose had refused to debate Nuckolls at this conference and that when Rose had submitted his paper on fusion to an actual scientific journal, it was rejected because of its distortions of facts.)

Controversy Over Soviet Pellet Designs

An important sidelight to the conference was the raging controversy over the Soviet claims for their high gain pellet designs for initial fusion. It turns out that the renowned Soviet Electron beam fusion scientist Leonid Rudakov's target design is not only unique in its utilization of soft x-rays for driving the implosion of the fusion fuel to high densities, but it is also extremely stable during the implosion, making the design many times more effective in terms of achieving higher fusion energy gains.

This controversy over the Soviet pellet designs and the success of the U.S. electron beam pellet fusion research program in using new, innovative pellet designs — which have major implications for basic science and which were described for the first time at the Atlanta conference — will be the subject of a future article.

— Charles B. Stevens