

ly. But only fusion has the potential to realize large enough fluxes of neutrons to make this a practical method of pumping laser beam weapons.

III. Particle beams

A more speculative application of the compact tokamak is that of providing an efficient means to store a high-energy, high-current electron beam. The Alcator's early experiments in 1974 demonstrated a new regime, termed the slide-away regime by Professor Coppi. In this regime, the tokamak plasma develops into two components: 1) a low-density, low-temperature plasma; 2) a high-energy, intense electron beam.

Prof. S. Yoshikawa of Princeton University has proposed utilizing this regime to produce an extremely efficient, very high-power compact electron beam storage ring. If successful, this approach would improve the total stored power of the electron beam a thousand-fold over existing, conventional storage rings. But in terms of stored beam energy per kilogram of mass of the storage ring system, the improvement could be much greater than a million-fold.

Existing storage rings are both large and inefficient. The plasma in the tokamak permits the electron beam to be stably confined in an extremely small space with great efficiency.

In order to be maintained, an electron beam moving in one direction must be matched by a positive return-current in the opposite direction. In conventional storage rings and accelerators, the return-current is carried along the inside wall of the vacuum chamber. This type of return-current setup experiences high resistances and thus produces significant overall power losses. In the tokamak, the positive return-current is carried in the plasma and the plasma has an extremely low resistance to the flow of the return-current. In this way, the tokamak could become an extremely efficient means of building up and storing a high-power electron beam.

Experiments at Lawrence Livermore National Laboratory over the past several years have demonstrated that plasmas are extremely efficient at focusing electron beams and curbing beam instabilities.

The resulting high-power beam could either be utilized directly as a beam weapon itself, or to energize another beam system, such as the free-electron laser.

IV. Antimatter

Leading scientists at Princeton Plasma Physics Laboratory in New Jersey, who have pioneered many of the concepts above, point out that the storage ring system could also have

Closing of FEF an attack on science

by Carol White

On April 21, the offices of the Fusion Energy Foundation (FEF) in Leesburg, Va., were sealed by federal marshals under a Chapter 7 involuntary bankruptcy law. A Chapter 7 ruling does not even apply to nonprofit foundations like FEF, but the Justice Department has summarily stopped publication of the FEF's 114,000-circulation magazine, *Fusion*, and its quarterly, the *International Journal of Fusion Energy*.

As readers of *EIR* are no doubt aware, the staff of FEF, myself included, have been frequent contributors to this magazine and have been involved in producing the *EIR Quarterly Economic Report*. The staff of FEF, and the scientists with whom we collaborated to produce *Fusion* magazine and the *International Journal of Fusion Energy*, have joined together to form a Committee to Defend Scientific Freedom, which will be bringing this arrogant abuse of judicial proceedings by the Justice Department, before the international scientific community, as well as to citizens in general, and to the two houses of the Congress. Appropriate action on the legal front is being taken as well.

In Europe, Dr. Jonathan Tennenbaum, director of the

Fusion Energy Foundation, Europe, is circulating a letter to the scientific community there, for endorsement. The following are excerpts:

"I am writing to call your attention to a monstrous violation of elementary rights of free speech and scientific enquiry, committed by the government of the United States of America in illegally taking over and shutting down an independent, nonprofit scientific institution, the Fusion Energy Foundation (FEF).

". . . In what U.S. Attorney Henry Hudson called 'the first move of its kind in U.S. history,' the 'involuntary bankruptcy' order was granted by a Virginia court in a secret (*ex parte*) proceeding without knowledge or representation of the FEF. The court order was granted and is being carried out in blatant violation of the elementary constitutional rights of the FEF, its employees and officers, and in spite of the fact that: 1) as an officially designated nonprofit organization, the FEF is legally not subject to the 'involuntary bankruptcy' clauses invoked; 2) the legitimacy of the fines in question is presently under appeal before a U.S. court which has agreed to hear the case; 3) no evidence was given of financial difficulties of the FEF which could justify bankruptcy proceedings against the Foundation.

"In the course of their actions against the FEF, Attorney Hudson and other U.S. Department of Justice officials have made no secret of the fact, that they are committed to shutting down the FEF by any means, regardless of constitutional and legal 'details.' The entire proceeding is being carried out in a manner typical of a totalitarian police-state.

". . . Suddenly and without warning, one of America's

major applications to the storage of antimatter. Again, the stored antimatter could either be utilized directly as a beam weapon or as a means of powering a second beam weapon.

Soviet plans

The three photos show the Soviet T-14 compact tokamak under assembly at the Troitsk site outside Moscow. According to Soviet scientist V. Golant, the T-14 should begin operation this year. The machine is under the scientific direction of Prof. Valerii A. Chuyanov of the Kurchatov Institute. Engineering of the machine is under the direction of Dr. Oleg G. Filatov of the Efremov Institute of Leningrad.

The T-14 follows the original specifications of Dr. Bruno Coppi. It has a minor radius of one-half meter and a major radius of slightly more than a meter. The copper magnet coils develop a maximum field of 230 kiloGauss.

Following the specifications developed at MIT—in particular, the Zephyr design developed jointly between scientists from MIT and West Germany—the T-14 will utilize plasma compression to achieve fusion ignition. This concept of plasma compression was first demonstrated at Princeton Plasma Physics Laboratory on the ATC tokamak in the early 1970s, and has since been explored on the Princeton TFTR.

few truly independent scientific institutions has been forced out of existence. Founded in 1974, the FEF soon gained wide recognition for its promotion of accelerated research and development of peaceful uses of fission and fusion energy, for its advocacy of applications of directed energy technology to antimissile defense and to new production methods in civilian industry, and for its detailed proposals for a revived U.S. space effort centering around the long-term exploration and colonization of Mars. The FEF is also noted for its opposition to the 'limits to growth' propaganda of the Club of Rome, and for its many published studies and scientific conferences devoted to applications of modern technology to agricultural and industrial development of the so-called Third World. The LaRouche-Riemann econometric model was elaborated by an FEF team of economists, physicists, and mathematicians, and applied to the design of economic development programs for a number of nations and regions of the world, including Africa, the Middle East, India, Mexico, and Peru.

"Most recently, the FEF has circulated detailed proposals for incorporating advanced biophysics methods into a scientific crash program to find a cure for AIDS. Through a series of private scientific seminars and public conferences, the FEF has played a pioneering role internationally in bringing together specialists in different fields of biology, biophysics, and medicine, to discuss the AIDS problem.

"Apart from these and other concrete accomplishments, it is the FEF's catalytic role in formulating and disseminating *scientific ideas* which has earned it the greatest recognition among researchers in diverse domains. Aided by extensive

The concept is to initially run the T-14 in a low plasma-density, low magnetic-field mode. This permits the plasma to be penetrated and heated by microwaves from gyrotrons set to the plasma electron cyclotron frequency. Once the plasma is heated sufficiently, the magnetic field is suddenly increased. This compresses the plasma column, causing further heating and an increase in density. This is projected to produce the conditions for full fusion plasma ignition—a condition where enough of the fusion energy generated is absorbed within the plasma to maintain the plasma at fusion temperatures.

The Princeton TFTR is currently scheduled to achieve simple fusion energy breakeven with deuterium-tritium fuel in about two years. The Western European JET tokamak is scheduled to reach the same goal also in about two years, and JET has the possibility of also achieving the more advanced goal of fusion plasma ignition. (Both TFTR and JET began operating several years ago.)

It is far more likely, however, that the Soviets will achieve both goals first, later this year. And the Soviets will have accomplished this with a machine whose design did not even exist until after TFTR and JET began operating, and 10 years after construction on TFTR and JET began.

studies of the history of science, the FEF pioneered the application of the 'phase-space geometric' methods of Gauss, Riemann, and Cantor to the mastery of nonlinear processes in physics, astrophysics, biology, and economic science.

"Support for the FEF's work has come from tens of thousands of subscribers to FEF publications, and supporting members of the Foundation throughout the United States. The FEF was granted and has maintained the official status of a nonprofit scientific organization, to which contributions are tax-deductible.

"The forced closing-down of the FEF is not an isolated event, nor merely part of a political witchhunt against one of its directors. These actions are a direct attack upon freedom of scientific research and freedom of speech in general. My colleagues in the United States have observed in recent months an ominous decline in independent scientific research. Laboratories and research programs, not fully controlled by government bureaucracy or giant corporations, are rapidly disappearing. Instead of free scientific enquiry and the fearless search for truth, it is increasingly peer-group pressure, fear of losing contracts, and compulsion to please the 'scientific mafia' controlling major research budgets, which determines the activities of American scientists. Unfortunately, this trend is not limited to the U.S. alone. Where scientific freedom declines, so does political freedom."

My former colleagues of the FEF, and I, are currently circulating a similar letter in the United States. Those of *EIR's* readers who wish to directly support our efforts, either financially, or through political action, may write to me in care of this magazine.