Maryland Controlled Fusion Energy Research Program

University of Maryland

Laboratory for Plasma and Fusion Energy Studies (LPF)

Department of Energy sponsored program

October 1, 1981 through December 31, 1983

Major areas of current research:

Maryland Theory Program

Maryland Experimental Program

- Magnetic mirror machine program
- Continuing electron cyclotron diagnostics work at the Princeton University Plasma Physics Laboratory
- Spheromak program
- Terp experiment
- Vacuum ultraviolet scattering program
- Atomic physics program
- Infrared laboratory program

MARYLAND CONTROLLED FUSION RESEARCH PROGRAM

The Controlled Fusion Energy Program involves close collaboration between the University of Maryland scientists, technical staff, and students working on the various magnetic fusion research efforts. This collaboration is fostered by the University of Maryland Laboratory for Plasma and Fusion Energy Studies (LPF). The number of Ph.D. scientists is about 50, the number of research students about 20. The total Laboratory personnel is approximately 100.

The research at Maryland involves close interplay with the national and international magnetic fusion research programs. This cooperation is emphasized by the seven major efforts of the current program here. The research program at Maryland continues to make significant, timely, and cost effective contributions in a number of areas of fusion. It also provides training for young scientists who are much needed in the national laboratories and by the growing fusion research and development efforts in industry. This Department of Energy sponsored program is funded at $3,754,000 for the period October 1, 1981 through December 31, 1983. The following are the major areas of current research:

- The Maryland Theory Program is dedicated to the following tasks:
  - To continue the basic studies of plasma confinement properties and scaling laws pertinent to major fusion devices with emphasis on the linear and nonlinear analysis of plasma instability, anomalous transport, heating and radiation.
  - To provide the theoretical support to the existing and proposed Maryland experimental programs in confinement systems (spheromak, TERP, and mirror), as well as Maryland cyclotron radiation measurements from tokamaks, EBT, and mirror machines.

- To continue our intensive research in rf interactions with plasmas for rf heating and current drive.
- To continue fruitful collaborations with experimentalists and theorists of major fusion laboratories and university fusion centers for close interplay of theory, experiment and simulation.

• The Maryland Experimental Program also has various components. The magnetic mirror program is devoted to developing electron cyclotron radiation diagnostics for mirror-confined plasmas with the goal being to obtain spatial and temporal information about the electron energy distribution for conditions typical of future large-scale mirror devices. At present, and in the near future, experiments will be conducted on gun-injected plasmas in the Maryland mirror machine. In the near future we also plan to make electron temperature measurements in TMX-U at Livermore. During the final three years of this program we would study ECRH and electron cyclotron diagnostics on a new modest-sized mirror machine at Maryland, and we would continue to perform experiments on the large mirror devices at Livermore.

- A Maryland team of plasma physicists continues their electron cyclotron diagnostics work at the Princeton University Plasma Physics Laboratory. They have contributed to various achievements in tokamak research, notably the achievement of thermonuclear temperatures in the PLT device. The Maryland team is now preparing for work on the Tokamak Fusion Test Reactor at Princeton.

- The spheromak program will proceed from the PS experiment by enlarging its size and prolonging its pulse time to enable us to study lifetime properties in a hot plasma with a 10 msec applied current pulse. In addition, we propose to build a larger, high field device called MS to obtian kilovolt temperature plasmas in a 0.1 sec experiment.

- The Terp experiment is used for studying the physics of high bets tokamak plasmas. In particular, ballooning instabilities are being investigated and results used to test theoretical models and computer simulations. Plans are being made to study the physics of high energy alpha particles interacting with the background plasma.

- In the vacuum ultraviolet scattering program we will measure the ambient background radiation at Ly α and Ly β for both ISX and TEXT rpior to interfacing a ruby-based /Ly α system or an excimer-based/Ly β system on these machines for measurements of neutral hydrogen densities by resonance scattering. More efficient processes for producing the VUV probe radiation will continue to be investigated.

- The atomic physics program is devoted to establishing an atomic data base for the assessment of impurity radiation from high temperature plasmas. Measurements are made of ionization, recombination, and excitation rate coefficients in iron-seeded, well-diagnosed laboratory plasmas to behchmark atomic physics codes for heavy element radiation.

- The infrared laboratory program is to develop submillimeter systems that meet the requirements for the electron cyclotron diagnostics program on tokamaks, spheromaks, mirrors, and EBT's, and to provide for the systematic testing of the submillimeter absorption and reflection properties of the windows, mirrors, wall materials, and vacuum vessel geometry used in magnetic confinement programs around the country.