JOINT INSTITUTE FOR FUSION THEORY

NEWSLETTER

December 1982

The Institute for Fusion Theory in Austin works with the International Center for Fusion Theory in Nagoya to form JIFT - the Joint Institute for Fusion Theory. The primary purpose of JIFT is to facilitate exchange visits and workshops between the scientists working on theoretical plasma physics problems associated with the development of fusion systems. The two component institutes are directed by M. N. Rosenbluth (Austin) and Y. H. Ichikawa (Nagoya). Exchange arrangements are organized by W. Horton (Austin) and K. Nishikawa (Hiroshima).

Exchange Visits

Dr. Tetsuo Kamimura, IPP, Nagoya, March-July 1982.

Dr. Kamimura spent five months as Visiting Scientist in the United States with home base in Austin. During this period he started new projects with numerous U.S. scientists as well as continuing collaborations. A major project reported on at the fall APS meeting is the development of implicit particle simulation codes designed in collaboration with D. C. Barnes, J. N. Leboeuf, T. Tajima, and A. Aydemir. In collaboration with J. D. Meiss and W. Horton, Kamimura investigated the evolution of drift wave instabilities into a mixture of waves and solitons. The visit of Kamimura to the U.S. was very fruitful for the many scientists in contact with him, including scientists at UCLA, Livermore and Austin.

Institute for Fusion Theory, University of Texas at Austin, Austin, Texas. Tele (512) 471-3396, FTS 734-5340. For suggestions write to W. Horton.

Dr. Toshio Tange, HIFT, Hiroshima University, Aug.-Jan, 1983

Dr. Tange arrived in Berkeley in August where he collaborated with the Berkeley fusion theorists and visited with Livermore scientists. In October he arrived in Austin where he continues his research in anomalous transport processes. In collaboration with A. K. Sen of Columbia, he is investigating the accummulation of drift wave energy at long wavelengths in the k spectrum where several theories predict a large peak in wave energy.

Dr. Sanae-Inoue Itoh, HIFT, Hiroshima University, Sept. 1982-Mar. 1983

Dr. Sanae Itoh arrived in Austin in September and continues her work on the theory of flux control and heating of plasmas by RF waves. She is also investigating the thermodynamic properties of the anomalous transport processes. In addition she is studying the kinetic theory of ballooning mode instabilities in collaboration with the JAERI theory group.

Dr. Kimitaka Itoh, JAERI, Sept. 1982-March 1983

Dr. Kimitaka Itoh arrived in Austin in September and continues his research into the kinetic theory of ballooning mode instabilities in high beta tokamak systems. In recent publications he and his colleagues show the nature of the transition from electrostatic toroidal drift wave-like instability to the MHD-like ballooning instability. He is also involved in studies of RF heating, flux control, and stabilization of MHD modes.

Dr. John Dawson, UCLA, September-December 1982
Visiting Professor at IPP, Nagoya

Report from John Dawson, November 4, 1982:

Nancy and I arrived in Nagoya on Sept. 3 and found the arrangements made for our stay very well organized. Professor Kakihana and the Institute staff gave us welcoming parties. As always, the Japanese hospitality is unsurpassed. Since arriving I have been engaged in a variety of activities: (1) I gave three lectures on "Advanced Fusion Reactors" which were well attended with quite a number of questions. (2) I made a three-day visit to the HIFT in Hiroshima and a one-day visit to the fusion group at Fukuoka.

Hiroshima

I am impressed by the vigor and productivity of the Hiroshima group. Although small, I think it is as good and productive as any group I have encountered. Particularly impressive were their three dimensional simulations of Compact Tori and the tilting instability. They have developed very sophisticated display and diagnostic codes needed to understand these complex systems.

Fukuoka

I made a one day visit to Fukuoka to the fusion group there; they are planning a superconductivity Tokamak (Major Radius 80cm, plasma dimensions 23.5 × 33cm, toroidal B_t = 60KG [first stage], 80KG [second stage], B_t/R = 7.5 [first stage], 10 [second stage], plasma current 125KA [first stage], 500KA [second stage], current density 200A/cm^2 [first stage], 795A/cm^2 [second stage]. The project is under the direction of Professor Satoshi Itoh. If I understood correctly the first stage has been approved and will provide the building and machine. The second stage will upgrade the machine. Interestingly they plan to use turbulent heating on this device. They appear to have successfully heated a smaller Tokamak by this means and to have confined the plasma. When I asked how their experiment differed from the Texas Turbulent Torus they said that they maintained the plasma equilibrium where as they felt it was lost after heating in the Texas machine. At both Hiroshima and Fukuoka I gave talks on synchrotron current drive in tokamaks.

Nagoya

With the help of Dr. Kamimura and Dr. Kato I looked into how much the $p^{11}B$ reaction might be enhanced by using polarized nuclei. It appears that the resonance at 800Kev is due to an excited state of ^{12}C with angular momentum 2. With the 3/2 spin of ^{11}B and the 1/2 spin of p, polarization could give an enhancement of a factor 1.6. A factor of 2 would have given the possibility of ignition. However, the factor 1.6 raises the potential Q for the driven system to 4 (if beam plasma interactions are included Q of 6 ~ 7 is theoretically possible). To take advantage of this one would require that there is enough $\underset{\sim}{B}$ field everywhere to keep the spins adiabatic. This can probably be done without enhancing the synchrotron radiation too much. We have also taken a cursory look at the polarization effects on a number of other reactions. Some of

these look like larger enhancements can be obtained: p^7Li looks like a factor of 2.67. However, for many of these reactions the data is incomplete and the density of levels so great that much more work needs to be done before the story is in.

Upcoming Exchange Visit

Dr. John Cary, IFS to Nagoya, March-June, 1983

Dr. David Montgomery, William & Mary to Nagoya
(Visiting Professor at IPP) May-August, 1983

Upcoming JIFT Workshops

(1) Statistical Physics and Chaos in Fusion Plasmas - Dec. 13-17, 1983

Organizers: W. Horton, L. E. Reichl and Y. H. Ichikawa
Location: IFS, Austin, Texas

Topics include statistical properties of nonlinear maps, transition to turbulence, dimension of strange attractors, formulations of kinetic equation, relative diffusion and Vlasov-Poisson turbulence.

(2) 3D MHD Studies - March 7-11, 1983

Organizers: B. Carreras, T. Sato
Location: Institute of Plasma Physics,
Nagoya, Japan

Small Workshops

(1) Hot Electron Physics - January 10-14, 1983

Organizers: Jim Van Dam, T. Watanabe
Location: IFS, Austin, Texas

(2) Anomalous Transport and Critical Beta - March 1983

Organizers: Bruno Coppi, Y. Tereshima

Workshops in the Planning Stage

Presently, JIFT is working on the following possible workshops:

(1) RF Heating and Current Drive

Organizers:	C. S. Liu and M. Porkolab S. Tanaka and R. Sugihara
Location:	U.S.

(2) Statistical Plasma Physics

Organizer:	J. Greene and Y. H. Ichikawa
Location:	Japan

(3) 3D MHD Toroidal Systems

Organizer:	B. Carreras and T. Sato
Location:	Oak Ridge National Laboratory

(4) Transport and Instability in Open Ended Systems

Organizer:	R. Cohen and T. Kamimura
Location:	Japan

APPENDIX

JIFT Workshops

The Joint Institute for Fusion Studies has organized the following Workshops since beginning operation in 1981.

1. "The Theory of Non-Axisymmetric Confinement Systems"
   December 8-12, 1980, Austin, Texas
   T. Kamimura and M. N. Rosenbluth
   IFS Report #5 (1981)

2. "Long-Time Prediction for Conservative Dynamical Systems"
   March 16-19, 1981, Lakeway, Texas
   W. Horton, L. Reichl and Y. Ichikawa
   "Long-Time Prediction in Dynamics", Editors Horton, Reichl and Szebehely (Wiley, December 1982).

3. "3D MHD Studies of Toroidal Devices"
   October 19-21, 1981, Oak Ridge, Tennessee
   B. Carreras and I. Kawakami
   Proceedings Conf.-8110101 (ORNL, 1982).

4. "Nonequilibrium Statistical Physics"
   November 9-13, 1981, Kyoto, Japan
   Allan N. Kaufman, John M. Greene and Kyoji Nishikawa

5. "Stellarator Equilibrium and Stability"
   December 14-18, 1981, Nagoya, Japan
   Shoichi Yoshikawa and M. Wakatani

6. "Drift Wave Turbulence"
   January 11-15, 1982, Austin, Texas
   T. Sato and M. N. Rosenbluth
   IFS Report #53 (1982).

JIFT Exchange Scientists

1. Atsushi Fukuyama, Okayama U., November 1980-March 1981
2. Daniel Barnes, IFS, March-May, 1981
3. Nat Fisch, PPPL, February-May, 1981
4. James W. Van Dam, IFS, May-October, 1981
5. Hirotada Abe, Kyoto U., September 1981-January 1982
6. Hank Strauss, NYU, July-September 1981
7. Charles F. Karney, PPPL, November 1981-February 1982
8. Allen Boozer, PPPL, February-May 1982
9. Tetsuo Kamimura, IPP, Nagoya, March-July 1982