

TO: Executive Secretaries of the US-Japan Fusion Research Collaboration
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Annual Report of JIFT Activities

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Annual Report of Activities

US-Japan Joint Institute for Fusion Theory

April 1, 2001–March 31, 2002

submitted by the

JIFT Steering Committee

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1. INTRODUCTION

The Joint Institute for Fusion Theory (JIFT) is one of the three programs through which the US-Japan Fusion Research Collaboration is organized. The other two programs are the Fusion Physics Planning Committee (FPPC) and the Fusion Technology Planning Committee (FTPC).

The distinctive objectives of the JIFT program are (1) to advance the theoretical understanding of plasmas, with special emphasis on stability, equilibrium, heating, and transport in magnetic fusion systems; and (2) to develop fundamental theoretical and computational tools and concepts for understanding nonlinear plasma phenomena. Both objectives are pursued through collaborations between U.S. and Japanese scientists by means of various types of exchange program activities—namely, workshops, exchange visitors, and joint computational projects.

Each year the JIFT program usually consists of four topical workshops (two in each country), six exchange scientists (three from each country), and a fluctuating number of joint computational projects (on the order of a dozen). So far, during its 21 years of successful operation, JIFT has sponsored 122 long-term visits by exchange scientists, 75 topical workshops, and 123 joint computational projects.

- The *workshops* typically have an attendance of 15–30 participants, of whom usually three to seven scientists (depending on the particular workshop) travel to the workshop from the non-host country. Scientists from countries other than the U.S. and Japan are also often invited to participate in JIFT workshops, either as observers or multi-laterals.
- Of the approximately three *exchange visitors* in each direction every year, one (called the “JIFT Visiting Professor”) is supported by the host country, while the others (called “Exchange Scientists”) are supported by the sending country. The visits of the Exchange Scientists usually last from several weeks to a month or two in duration, whereas the Visiting Professors normally stay for three months.
- The third category of JIFT exchange activities consists of *joint computational projects*. In general these are continuing collaborations on various problems of current interest, which initially develop out of interactions at workshops and through individual exchange visits.

The topics and also the participating scientists for the JIFT exchange visits, workshops, and joint computational projects are selected so as to have a balanced representation of critical issues in magnetic fusion research, including both fundamental problems as well as questions of near-term significance, and also to take into account the specific capabilities and interests of both countries. The Japanese and US members of the JIFT Steering Committee agree together on the appropriateness of proposed topics before recommending them.

2. STATUS OF CURRENT ACTIVITIES (2001-2002 PROGRAM)

Almost all of the activities in the three categories—workshops, personal exchanges, and joint computational projects—that had been scheduled for the 2001-2002 JIFT program were carried out during the past year. All four workshops were successfully held, in addition to the JIFT Steering Committee meeting. In the category of personal exchanges, two Visiting Professors and eight Visiting Scientists made exchange visits, while three other Visiting Scientist visits were deferred. The JIFT joint computational projects were also active.

The JIFT activities for the past year (April 1, 2001-March 31, 2002) are listed below, with brief annotations concerning attendance, location, and dates.

A. 2001-2002 Workshops

US to Japan:

- JF1-01 *JIFT Steering Committee Meeting*
Organizers: T. Sato (NIFS); J. Van Dam (IFS Texas)
Niseko, Hokkaido, July 3, 2001
- JF1-02 *Equilibrium, Stability, and Transport in Torus Plasmas*
Organizers: M. Okamoto (NIFS); J. Van Dam (IFS Texas)
Niseko, Hokkaido, July 1-6, 2001

- JF1-03 *High Field Science*
Organizers: K. Mima (Osaka ILE); T. Cowan (General Atomics)
Ritsumei University, Kusatsu, Shiga, March 24_27, 2002

Japan to US:

- JF1-08 *Scope of Complexity Science*
Organizers: R. Horiuchi (NIFS); W. Horton (IFS Texas)
University of Texas, Austin, March 10_15, 2002
- JF1-09 *Innovative Methods in Theoretical Analysis of Collective Phenomena in Plasmas*
Organizers: Z. Yoshida (U. Tokyo); S. Mahajan (IFS Texas)
University of Texas, Austin, January 7–13, 2002

B. 2001-2002 Exchange Visits

Japan to US:

- JF1-11 *Study on Self-Organization of Non-Equilibrium, Open, and Nonlinear System*
H. Nakamura (NIFS), Visiting Professor
IFS, U. Texas, Austin; March 22–June 21, 2002 (three months); paid by IFS
- JF1-12 *Study on the Zonal Flow Effect on Plasma Microturbulence*
M. Yagi (Kyushu U.), Visiting Scientist
PPPL & UCSD; September 17–December 14, 2001 (three months); paid by Japan
- JF1-13 *Theoretical Analysis on Stability of Shear Flow Plasmas*
T. Tatsuno (U. Tokyo), Visiting Scientist
IFS, U. Texas, Austin; January 7–March 1, 2002 (two months); paid by Japan
- JF1-10 *Influence of Magnetic Field Structure on Magnetic Curvature and Shear*
N. Nakajima (NIFS), Visiting Scientist
PPPL; March 4–23, 2001; paid by Japan
- JF1-15 *Modeling of Relaxation Phenomena in Spherical Tokamak*
N. Mizuguchi (NIFS), Visiting Scientist
PPPL; February 18–22, 2002; paid by Japan

US to Japan:

- JF1-07 *Development of Particle Simulation Code for Open System*
C. K. Birdsall (UC Berkeley), Visiting Professor
NIFS; March 20–June 19, 2002; (three months); paid by Japan
- JF1-04 *Comparison between Theory and Experiment on Transport*
D. R. Mikkelsen (PPPL), Visiting Scientist
NIFS; May 10–15, 2001 (deferred JF1-15 from 2000); paid by US
- JF1-?? *MHD Equilibrium for Helical System*
D. Monticello (PPPL), Visiting Scientist
NIFS, April 20–May 13, 2001
- JF1-?? *Physics Consideration on New Helical System*
M. S. Chu (General Atomics), Visiting Scientist
NIFS, Kyoto, & JAERI; visit deferred
- JF1-06 *Microinstability Analysis of Magnetically Confined Plasmas*
G. Rewoldt (PPPL), Visiting Scientist
NIFS and JAERI; visit deferred
- JF1-05 *LHD High Beta Data Analysis*
G. Y. Fu (PPPL), Visiting Scientist
NIFS; two weeks; visit deferred

C. 2001-2002 Joint Computational Projects

- JF2-01 *MHD Stability in Advanced Tokamaks*
S. Tokuda, Y. Ishii, M. Ozeki, M. Azumi (JAERI);
J. Manickam (PPPL), A. Aydemir (IFS)
1 week; 1 person to US; continued from 2000-2001
- JF2-02 *3-D Codes and Island Formation*
A. Boozer (Columbia); D. Monticello (PPPL); C. Hegna (Wisconsin);
T. Hayashi, R. Kanno (NIFS), Y. Nakamura (Kyoto U.)
2 weeks; 1 person to US; continued from 2000-2001
- JF2-03 *New Simulation Algorithms for Massively Parallel Processing*
V. Decyk (UCLA), W. Tang (PPPL);
K. Watanabe, R. Horiuchi, S. Ishiguro (NIFS)
2 weeks; 1 person to US; continued from 2000-2001
- JF2-04 *Toroidal Simulation and Plasma Transport Modeling*
T. Tajima (LLNL), W. Horton (IFS);
Y. Kishimoto, A. Azumi (JAERI), M. Takamaru (NIFS)
1 week; 1 person to US; continued from 2000-2001
- JF2-05 *Numerical Study of High Energy Particle Effect on MHD Stability*
C.Z. Cheng (PPPL), J. Van Dam (IFS);
M. Azumi, T. Ozeki (JAERI), Y. Todo (NIFS)
1 week; 1 person to US; continued from 2000-2001
- JF2-06 *Turbulent Transport Applications to Tokamaks and Helical Systems*
B. Carreras (ORNL), W. Horton (IFS);
M. Wakatani, Y. Nakamura (Kyoto), M. Yokoyama (NIFS)
1 week; 1 person to US; continued from 2000-2001
- JF2-07 *Tokamak Simulation on Massively Parallel Computers*
B. Carreras, D. Spong (ORNL), J.N. Leboeuf (UCLA), V. Decyk (UCLA);
S. Tokuda, G. Kurita (JAERI), T. Watanabe (NIFS)
1 week; 1 person to US; continued from 2000-2001
- JF2-08 *MHD and Transport Phenomena in Toroidal Systems*
W. Tang, G. Rewoldt, C.Z. Cheng (PPPL);
H. Sugama, R. Ishizaki (NIFS)
1 week; 1 person to US; continued from 2000-2001
- JF2-09 *Kinetic Effects on MHD Phenomena*
J. Van Dam, H. Berk (IFS);
M. Okamoto, N. Nakajima, K. Ichiguchi (NIFS)
1 week; 1 person to US; continued from 2000-2001
- JF2-10 *Two-Fluid Model for Plasma Simulation*
B. Coppi, T. Takaya, L. Sugiyama (MIT); T. Sato, H. Miura (NIFS)
1 week; 1 person to US; continued from 2000-2001
- JF2-11 *Gyrokinetic Transport Simulation*
V. Decyk, R. Sydora (UCLA), W. Lee (PPPL);
T. Sato, T. Takayama (NIFS), H. Naitou (Yamaguchi)
2 weeks; 1 person to Japan; continued from 2000-2001
- JF2-12 *Plasma Rotation, Vortices, and Anomalous Transport*
W. Horton, A. Aydemir (IFS); B. Carreras (ORNL);
T. Sato, M. Okamoto, S. Murakami (NIFS), M. Wakatani (Kyoto)
3 weeks; 1 person to Japan; continued from 2000-2001

3. TECHNICAL PROGRESS HIGHLIGHTS

The four 2001-2002 JIFT *workshops* were on topics of timely interest and had stimulating participation by both theoretical and computational scientists, as well as some experimentalists.

- The workshop on *Equilibrium, Stability, and Transport in Torus Plasmas* was held jointly with the Sixth International Workshop on the Relationship between Plasma Experiments in the Laboratory and Space (IPELS) in order that the field of magnetic confinement theory could interact with related fields such as space plasma physics, inertia fusion, plasma applications, etc. Interchange between theory and experiment was also accomplished. This joint workshop promoted enhanced understanding among the various fields. For example, quite a few presentations about theoretical and experimental research on magnetic reconnection were given, both in fusion plasmas and space plasmas. Another topic at the workshop overlapping many fields was that of Alfvén waves. It was reported that a large-amplitude Alfvén wave breaks adiabaticity and causes stochastic heating due to nonlinear resonance. Toroidal Alfvén Eigenmode (TAE) destabilization and the accompanying burst phenomena observed in the TFTR tokamak were reproduced in numerical simulations. Compressional Alfvén waves were discussed both in the context of the NSTX experiment and in space. A review of Alfvén waves and specifically TAE modes was given for both fusion and space. Nonlocal transport and plasma turbulence were timely topics, being related to recent magnetic confinement theories and experiments. Recent experimental results from the LHD and Heliotron-J helical experiments were presented. The importance of computational science was emphasized, and large-scale computational science projects were described (in particular, the new SciDAC initiative in the US). The workshop promoted mutual understanding among various fields, which was creative and fruitful for magnetic confinement theory.
- The workshop on *High Field Science* continued what has become an extremely fruitful line of research in the JIFT program over the last several years. Theoretical and simulation studies were presented on the generation of high-energy particles, relativistic and nonlinear wave phenomena, and relativistic electromagnetic phenomena related to interactions between plasmas and ultra-intense lasers for a fast-ignitor device. This workshop was to have been held in the fall of 2001, in conjunction with the biennial Conference on Inertial Fusion Science and Applications (Kyoto, Japan). However, it was postponed to March 2002, due to the September terrorist events in the US.
- The workshop on *Scope of Complexity Science* was quite stimulating. One of the purposes for this workshop was to generalize simulation techniques to other fields. Another purpose was to explore the universality underlying various fields through an examination of cross-cutting topics, such as self-organization and complexity in confined plasmas, space plasmas, and other fields such as biophysics. The topics covered complex systems with self-organization and structure formation in magnetically confined plasmas, inertia fusion plasmas, space plasmas, bifurcation to quasi-steady states, polymer dynamics and their coherent structure formation, complexity in DNA, and biophysics. The workshop emphasized the importance of the visualization of simulation results. Virtual reality devices were introduced from The University of Texas and NIFS. Three-dimensional, barrier-free virtual reality technique and a visualization method using pattern recognition technique were described.
- The workshop on *Innovative Methods in Theoretical Analysis of Collective Phenomena in Plasmas* discussed theoretical methodology for subjects such as chaos behavior, the three-dimensional structure of magnetic fields, and the effect of shear flow in toroidal plasmas. The topic of plasma flow took a leading role in the workshop. The sheared flow appearing in the enhanced confinement H-mode and in double Beltrami equilibrium, and a new type of confinement method utilizing fast rotating flow were discussed from the point of view of self-organization, with attention paid to plasma structure formation due to electron and/or ion flow. Non-Hermitian dynamics was discussed for fluctuations in plasma with flow. Other topics were applications of the methodology developed for fusion plasma physics to fields such as space plasma physics.

The JIFT *exchange visits* during 2001-2002 have also been productive, in terms of collaborations established, research accomplished, and papers written. Here we mention just a few highlights.

- *Dr. M. Yagi* (Kyushu U.) visited PPPL and UCSD and developed a kinetic-fluid model simulation code to study zonal flows. The numerical model includes a linear dispersion relation that is more accurate than the conventional gyro-fluid model. This model is being extended to treat instabilities in the short-wavelength region, which has not been previously considered.

- *Dr. T. Tatsuno* (U. Tokyo) conducted theoretical studies of the stability of a plasma with flow. This problem had not yet completely been understood due to its mathematical difficulty. In collaboration with Dr. S. Mahajan, he examined rigorously the effect of the flow on linear stability in the presence of interchange instabilities in an incompressible plasma. He also discussed the explosive instability in a discrete nonlinear dynamic system corresponding to non-Hermitian operators.
- *Dr. N. Nakajima* (NIFS) visited PPPL for three weeks. The purpose of his visit was to extend the HINST code, which calculates non-perturbatively the effect of energetic particles on MHD modes, to three-dimensional equilibria, for application to LHD and CHS experiments. Collaborating with Drs. C. Z. Cheng and N. Gorelenkov, he created an interface with the three-dimensional equilibrium code and the coordinate transformation to the Boozer coordinate system. As a result, he was able to complete a benchmark test for comparing the behavior of ideal ballooning modes in a tokamak and the LHD torsatron. The improvement of bounce averaging of trapped particles is now under way. He also discussed the delta-f method for neoclassical transport with Dr. W. Wang. This collaboration will continue at both NIFS and PPPL. Another collaboration, with Drs. Nazikian, Monticello, and Reiman, will run a benchmark test between the 3-D HINT code and the PIES code. It is hoped that the results could be presented at the JIFT workshop proposed to be held in November, 2002, at PPPL. This project is closely related to the development of a magnetic probe diagnostic at NIFS. The problem of the re-construction of equilibria in LHD and NCSX was also discussed.
- *Dr. N. Mizuguchi* (NIFS) worked with experimentalists who operate the NSTX experiment at PPPL and compared his simulation results for MHD nonlinear phenomena with the experimental observations.
- *Dr. D. Mikkelsen* (PPPL) considered transport in the LHD and CHS helical devices in order to make a comparison between theory and experiment. With Drs. S. Murakami, N. Nakajima, S. Okamura, S. Sudo, H. Yamada, and K. Yamazaki he explored possibilities for collaborative research on helical systems.
- *Dr. D. Monticello* (PPPL) interacted with Drs. S. Okamura, C. Suzuki, T. Hayashi, K. Itoh, K. Ichiguchi, R. Kanno, M. Okamoto, and T. Sato at NIFS. He ported the PIES code to the SX-5 computer at NIFS. A test case was set up to compare the PIES and HINT codes. Most of his work was on the topics of MHD equilibrium and stability for quasi-axisymmetric helical devices.
- *Dr. H. Nakamura* (NIFS) went to the University of Texas at the end of March, 2002, to collaborate with IFS scientists on the study on self-organization for non-equilibrium systems. He will work at IFS for three months as the JIFT Visiting Professor to the US.
- *Dr. C. Birdsall* (UC Berkley) arrived at NIFS in March and assumed his position of JIFT Visiting Professor and Guest Foreign Professor. He will stay at NIFS for three months. He will present a three-day introductory course (May 8-10) for beginners in numerical simulation. He will also present six 90-minute seminars, which will involve various demonstrations of numerical simulations. He is also working on a new edition of his book on plasma simulation.

Twelve JIFT *joint computational projects* on various topics were also active during the past year. Some of these projects involved limited travel.

4. PROGRAM ADMINISTRATION

JIFT has a Steering Committee consisting of eight members, four from each country. Two of these members are the Japanese and US co-chairmen. Two other members of the Steering Committee, the US and Japanese co-executive secretaries, are responsible for the ongoing daily oversight of the progress of JIFT activities. The co-chairman and co-executive secretary on the US side are, respectively, the director and assistant director of the Institute for Fusion Studies (IFS) of The University of Texas at Austin. The Japanese co-chairman has been the director of the Theory and Computer Simulation Center at the National Institute for Fusion Studies. Furthermore, on the Japanese side there is one official Advisor, who is from the Japan Atomic Energy Research Institute; and on the US side there is an Advisory Committee comprised of several members representing a spectrum of US universities and national laboratories. The names of the persons on the Steering Committee and the names of the Advisors are listed below:

JIFT Steering Committee

US Members

J. Van Dam (IFS)—Co-Chairman
F. Waelbroeck (IFS)—Co-Exec. Secretary
M. Crisp (DOE)

Japanese Members

T. Sato (NIFS)—Co-Chairman
M. Okamoto (NIFS)—Co-Exec. Secretary
M. Wakatani (Kyoto U.)
K. Mima (Osaka U.)

JIFT Advisors

Japanese Advisor: Y. Kishimoto (JAERI)

US Advisory Committee: A. Aydemir (IFS), P. Catto (MIT), B. Carreras (ORNL), V. Chan (GA), B. Cohen (LLNL), W. Horton (IFS), J. Leboeuf (ORNL), W. Tang (PPPL), and P. Terry (UWM)

A number of changes in the composition of the JIFT Steering Committee occurred during the past year. In January Dr. R. Hazeltine stepped down as director of the IFS and also as the US-co-chairman; he was replaced in both positions by Dr. J. Van Dam, currently the IFS interim director. Dr. F. Waelbroeck, now the IFS assistant director, became the new US co-executive secretary for JIFT. On the Japanese side, Dr. T. Sato will leave his current position in the new Japanese fiscal year that begins April 1, 2002, and it is anticipated that Dr. M. Okamoto, who had been the Japanese co-executive secretary, will replace him as the new Japanese co-chairman. Also, Dr. W. Sadowski retired from the US Department of Energy in January and was replaced on the JIFT Steering Committee by Dr. M. Crisp (DOE). The important contributions of Dr. Hazeltine, Dr. Sato, and Dr. Sadowski have been highly appreciated. Finally, Dr. J. Dawson, a member of the JIFT Steering Committee for over twenty years, passed away in November 2001; he had played a very key role in the initial establishment of the JIFT program, and his participation and wisdom over the years were invaluable. (To celebrate his scientific accomplishments and role in US-Japan fusion theory collaborations, a two-day JIFT workshop on plasma simulations is being planned for May 2002 at UCLA, in conjunction with a one-day Symposium hosted by UCLA.)

The JIFT Steering Committee attempts to schedule workshops in such a way as to dovetail with other meetings. It also tries to involve participation at workshops by interested experimentalists and to invite relevant available scientists from other countries to attend workshops.

As the principal program for fundamental theoretical exchanges in the US-Japan Fusion Research Collaboration, JIFT operates alongside the Fusion Physics Planning Committee (FPPC) and the Fusion Technology Planning Committee (FTPC). In particular, the JIFT activities are coordinated with the four FPPC areas of activity, viz., core plasma phenomena, edge behavior and control, heating and current drive, and new approaches and diagnostics.

5. RECENT JIFT-RELATED PUBLICATIONS

Below are listed a number of papers that either have been or will be published in connection with JIFT activities.

V. I. Berezhiani, S. M. Mahajan, Z. Yoshida, and M. Ohhashi, "Self-trapping of strong electromagnetic beams in relativistic plasmas," Institute for Fusion Studies Report No. IFS-925 (March 2001), to be published.

B. A. Carreras, V. E. Lynch, K. Ichiguchi, M. Wakatani, and T. Tatsuno, "On the application of local asymptotic criteria to stellarator stability", *Phy. Plasmas* **8** (3), 990-996 (2001).

C. Z. Cheng, N. N. Gorelenkov, G. J. Kramer, R. Nazikan, Y. Kusama, K. Shinohara, and T. Ozeki "N-NBI excitation of frequency chirping modes in JT-60U experiments," to be published in *Proceedings of the 7th IAEA Technical Committee Meeting on Energetic Particles in Magnetic Confinement Systems* (Gothenberg, Sweden, 8-11 Oct., 2001), paper OT-22.

W. C. Chou, R. Matsumoto, T. Tajima, M. Umekawa, and K. Shibata, "Dynamics of the Parker-Jeans instability in a galactic gaseous disk," *Ap. J.* **538**, 710-727 (2000).

J. Q. Dong, W. Horton, and Y. Kishimoto, "Gyrokinetic study of ion temperature gradient instability in vicinity of flux surfaces with reversed magnetic shear," *Phys. Plasmas* **8** (1), 167-173 (2001).

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- W. Horton, F. Porcelli, P. Zhu, A. Aydemir, Y. Kishimoto, and T. Tajima, "Ignitor physics assessment and confinement projects," *Nucl. Fusion* **42**, 169-179 (2002).
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- Hantao Ji, Jeremy Goodman, and Akira Kageyama, "Magnetorotational instability in a rotating liquid metal annulus," *Monthly Notices of Royal Astronomical Society Letter* **325**, L1-L5 (2001).
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- Y. Kishimoto, T. Masaki, and T. Tajima, "High energy ions and nuclear fusion in laser-plasma interaction," *Phys. Plasmas* **9**, 589-601 (2002).
- A. Maluckov, N. Nakajima, M. Okamoto, S. Murakami, and R. Kanno, "Statistical properties of the neoclassical diffusion in a tokamak equilibrium," *Plasma Phys. Control. Fusion* **43** 1211-1226 (2001).
- A. Maluckov, N. Nakajima, M. Okamoto, S. Murakami, and R. Kanno, "Statistical properties of the particle radial diffusion in a radially bounded irregular magnetic field," National Institute for Fusion Science Report No. NIFS-715 (October 2001), submitted for publication.
- D. R. Mikkelsen, H. Shirai, N. Asakura, T. Fujita, T. Fukuda, T. Hatae, S. Ide, A. Isayama, Y. Kamada, Y. Kawano, Y. Koide, O. Naito, Y. Sakamoto, T. Takizuka, and H. Urano, "Correlation between core and pedestal temperatures in JT-60U: Experiment and modeling," Princeton Plasma Physics Laboratory Report No. PPPL-3512 (2001), submitted for publication in *Nuclear Fusion*.
- N. Mizuguchi, T. Hayashi, and T. Sato, "Convective loss of heat energy excited in the edge region of spherical tokamak," *Contributions to Plasma Physics*, in press.
- Shuichi Ohsaki, Zensho Yoshida, Nana Shatashvili, and Swadesh M. Mahajan, "Eruptive events in the solar atmosphere," Institute for Fusion Studies Report No. IFS-927 (March 2001), to be published in *Astrophys. Rev. Letts*.
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K. Shinohara, M. Takechi, M. Ishikawa, Y. Kusama, N. N. Gorelenkov, C. Z. Cheng, A. Morioka, N. Oyama, K. Tobita, T. Ozeki, G. J. Kramer, and R. Nazikian, "Recent progress of Alfvén eigenmode experiments using NNB in JT-60U tokamak," to be published in *Proceedings of the 7th IAEA Technical Committee Meeting on Energetic Particles in Magnetic Confinement Systems* (Gothenberg, Sweden, 8-11 Oct., 2001), invited talk/paper IT-12.

K. Shinohara, M. Takechi, M. Ishikawa, Y. Kusama, N. N. Gorelenkov, C. Z. Cheng, A. Morioka, N. Oyama, K. Tobita, T. Ozeki, G. J. Kramer, and R. Nazikian, "Recent progress of Alfvén eigenmode experiments using NNB in JT-60U tokamak," to be published in *Nucl. Fusion* (2002).

H. Sugama, T.-H. Watanabe, and W. Horton, "Collisionless kinetic-fluid closure and its application to the three-mode ion temperature gradient driven system", *Phys. Plasmas* **8** (6) 2617-2628 (2001).

T. Tajima, Y. Kishimoto, and T. Masaki, "Cluster fusion," *Physica Scripta* **T89**, 45-48 (2001).

T. Tatsuno, V. I. Berezhiani, and S. M. Mahajan, "Vortex solitons: Mass, energy, and angular momentum bunching in relativistic electron-positron plasmas," *Phys. Rev. E* **63**, 046403-1 – 046403-7 (2001).

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6. PLANS FOR FUTURE ACTIVITIES (PROPOSED 2002-2003 PROGRAM)

The topics and themes of the exchange activities that have been proposed for the next year (April 1, 2002–March 31, 2003) are consistent with the traditional emphasis of JIFT on fundamental theoretical plasma physics issues. At the same time the proposed activities have direct relevance to the fusion science programmatic interests of both countries. The schedule of proposed activities for the coming year (2002-2003) is listed below.

A. 2002-2003 Proposed Workshops

US to Japan:

JF-1 *Structural Formation and Drift Wave/MHD Turbulence*

Organizers: Masatoshi Yagi (Kyushu U.) and Patrick Diamond (UCSD)

Proposed Place/Time: Kyushu U., Fukuoka, Japan; September 11–13, 2002

JF-2 *New Development of Simulation Science*

Organizers: Masao Okamoto (NIFS) and William Tang (PPPL)

Proposed Place/Time: Graduate University for Advanced Studies, Kanagawa, Japan; March 12–15, 2003

Japan to US:

- JF-8 *Theoretical Consideration on Helical Plasmas*
Organizers: Noriyoshi Nakajima (NIFS) and Donald Monticello (PPPL)
Proposed Place/Time: PPPL, Princeton, NJ; September 15–21, 2002
- JF-9 *Particle Simulation and Parallelization*
Organizers: Masao Okamoto (NIFS), James Van Dam (IFS Texas), Jean-Noel Leboeuf and Viktor Decyk (UCLA)
Proposed Place/Time: UCLA, Los Angeles, CA; May 16–17, 2002
(back-to-back with the Dawson Symposium, May 18, 2002)
- JF-10 *JIFT Steering Committee Meeting*
Organizers: M. Okamoto (NIFS); J. Van Dam (IFS)
Proposed Place/Time: to be determined

B. 2002-2003 Proposed Exchange Visits

Japan to US:

- JF-11 *Kinetic Simulation Study on Drift Wave Turbulence*
Tomohiko Watanabe (NIFS), Visiting Professor
IFS; July 1–31, 2002 (one month); paid by US (IFS)
- JF-12 *Effects of Vortex Generation on the Kinetic Internal Kink Mode*
Hiroshi Naitou (Yamaguchi U.), Visiting Scientist
UCLA; August 1–September 30, 2002 (two months); paid by Japan
- JF-13 *Basic Study for 3-Dimensional Analysis of Divertor Plasma*
Arimichi Takayama (NIFS), Visiting Scientist
UCSD; January 8–February 21 (two months); paid by Japan
- JF-14 *Study on the Zonal Flow Effect on Plasma Microturbulence*
Masatoshi Yagi (Kyushu U.), Visiting Scientist
PPPL and UCSD; July 25–August 4, 2002 (11 days); paid by Japan

US to Japan:

- JF-3 *Edge and Divertor Plasma for Reduction of Heat Load to Divertor Plates*
Sergei Krasheninnikov (UCSD), Visiting Professor
NIFS; July 1–September 30, 2002 (three months); paid by Japan
- JF-4 *Analysis of Micro-instability in LHD and JT-60U Plasmas*
Greg Rewoldt (PPPL), Visiting Scientist
NIFS and JAERI; June 22–July 5, 2002 (two weeks); paid by US
(deferred from October 2001, due to terrorist attack of 9/11/01)
- JF-5 *LHD High Beta Plasma Analysis*
Guoyong Fu (PPPL), Visiting Scientist
NIFS and JAERI; two weeks; paid by US
(deferred from last year)
- Physics Consideration on New Helical System*
M. S. Chu (General Atomics), Visiting Scientist
NIFS, Kyoto, & JAERI; two weeks; paid by US
(deferred from last year)

C. 2002-2003 Proposed Joint Computational Projects

- JF-15 *MHD Stability in Advanced Tokamaks*
S. Tokuda, Y. Ishii, M. Ozeki, and M. Azumi (JAERI);
J. Manickam (PPPL), A. Aydemir (IFS)
1 week; 1 person to US; continued from 2001-2002
- JF-6 *Gyrokinetic Transport Simulation*
V. Decyk, R. Sydora (UCLA), W. Lee (PPPL);
T. Takayama (NIFS), H. Naitou (Yamaguchi)
2 weeks; 1 person to Japan; continued from 2001-2002
- JF-7 *Plasma Rotation, Vortices, and Anomalous Transport*
W. Horton, A. Aydemir, K. Shaing (IFS), B. Carreras (ORNL);
M. Okamoto, S. Murakami (NIFS), M. Wakatani (Kyoto)
3 weeks; 1 person to Japan; continued from 2001-2002
- JF-16 *3-D Codes and Island Formation*
A. Boozer (Columbia); D. Monticello (PPPL); C. Hegna (Wisc.);
T. Hayashi, R. Kanno (NIFS), Y. Nakamura (Kyoto U.)
2 weeks; 1 person to US; continued from 2001-2002
- JF-17 *New Simulation Algorithms for Massively Parallel Processing*
V. Decyk (UCLA), W. Tang (PPPL);
K. Watanabe, R. Horiuchi, S. Ishiguro (NIFS)
2 weeks; 1 person to US; continued from 2001-2002
- JF-18 *Toroidal Simulation and Plasma Transport Modeling*
W. Horton (IFS); Y. Kishimoto, A. Azumi (JAERI), H. Takamaru(NIFS)
1 week; 1 person to US; continued from 2001-2002
- JF-19 *Numerical Study of High Energy Particle Effect on MHD Stability*
C.Z. Cheng (PPPL), J. Van Dam (IFS); M. Azumi, T. Ozeki (JAERI), Y. Todo (NIFS)
1 week; 1 person to US; continued from 2001-2002
- JF-20 *Turbulent Transport Applications to Tokamaks and Helical Systems*
B. Carreras (ORNL); W. Horton (IFS)
M. Wakatani and Y. Nakamura (Kyoto); M. Yokoyama (NIFS)
1 week; 1 person to US; continued from 2001-2002
- JF-21 *Tokamak Simulation on Massively Parallel Computers*
B. Carreras, D. Spong (ORNL), J.N. Leboeuf, V. Decyk (UCLA);
S. Tokuda, G. Kurita (JAERI), T. Watanabe (NIFS)
1 week; 1 person to US; continued from 2001-2002
- JF-22 *MHD and Transport Phenomena in Toroidal Systems*
W. Tang, G. Rewoldt, C.Z. Cheng (PPPL); H. Sugama, and R. Ishizaki (NIFS)
1 week; 1 person to US; continued from 2000-2001
- JF-23 *Kinetic Effects on MHD Phenomena*
J. Van Dam, H. Berk (IFS); M. Okamoto, N. Nakajima, K. Ichiguchi (NIFS)
1 week; 1 person to US; continued from 2000-2001
- JF-24 *Two-Fluid Model for Plasma Simulation*
B. Coppi, T. Takaya, L. Sugiyama (MIT); T. Hayashi (NIFS)
1 week; 1 person to US; continued from 2000-2001