TO: Executive Secretaries of the US-Japan Fusion Research Collaboration

FROM: Steering Committee, US-Japan Joint Institute for Fusion Theory (JIFT)

DATE: April 11, 2005

SUBJECT: JIFT Annual Report of Activities for 2004-2005

CONTENTS:

James W. Van Dam
US Co-Chairman, JIFT Steering Committee
Director, Institute for Fusion Studies
The University of Texas at Austin
Austin, Texas 78712, USA

Masao Okamoto
JA Co-Chairman, JIFT Steering Committee
Director, Theory and Computer Simulation Center
National Institute for Fusion Science
Oroshi 322-6, Toki, Gifu 509-5292, Japan

Annual Report of Activities

US-Japan Joint Institute for Fusion Theory

April 1, 2004–March 31, 2005

submitted by the

JIFT Steering Committee

Co-Chairmen: M. Okamoto and J. W. Van Dam

Co-Executive Secretaries: R. Horiuchi and F. L. Waelbroeck

April 11, 2005

TABLE OF CONTENTS

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 three 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 23 years of successful operation, JIFT has sponsored 134 long-term visits by exchange scientists, 83 topical workshops, and 153 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. *SUMMARY OF COMPLETED ACTIVITIES (2004-2005 PROGRAM)*

Almost all of the activities in the three categories—workshops, personal exchanges, and joint computational projects—that had been scheduled for the 2004-2005 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, three Visiting Professors (one more than the usual number) and six Visiting Scientists made exchange visits, while two other exchange visits were deferred. The JIFT joint computational projects were also active.

Summary reports about the JIFT activities for the past year (April 1, 2004–March 31, 2005) are given below.

A. 2004-2005 Workshops

US to Japan:

JF1-01 ***Progress of Theoretical Analyses in Three Dimensional Configuration***
Organizers: Noriyoshi Nakajima (NIFS) and Donald Monticello (PPPL)
Location: Kyoto University, Kyoto, Japan
Dates: January 25-27, 2005
Summary:

This JIFT workshop was held as a joint meeting with the 2nd 21COE plasma theory workshop of Kyoto University. Participants included five US scientists, five international scientists currently working in Japan, and

23 Japanese scientists. Five Japanese graduate students also attended. A key feature of this workshop was the close relationship between theoreticians and experimentalists through discussions. A fairly broad range of topics having to do with aspects of stability and confinement in three-dimensional configurations was covered. A major theme at the workshop was theoretical analysis of LHD data, in particular, the high beta shots (4.2%) and the divertor operation. The presentations covered 1) application of MHD equilibrium theory to experimental plasmas including reconstruction of MHD equilibrium from experimental results, 2) MHD stability analyses related to experimental results, 3) extended MHD theory including diamagnetic rotation and other two-fluid effects, 4) interaction between MHD stable modes and energetic particles, 5) neoclassical analyses (bootstrap current, radial electric field, particle orbit using the second adiabatic invariant) related to experimental results, 6) topics on non-local neoclassical transport and micro instability turbulence, and 7) pellet analyses to resolve experimental observations. A brief report about the workshop will be submitted to the "Stellarator News" newsletter for inclusion in the next issue.

Related publications:

All of the talks have been posted on-line at the workshop web site:
http://www.center.iae.kyoto-u.ac.jp/kondok/meetings/jift/presentations.html.

JF1-02 ***Theory and Simulation Research on Ultra-Intense EM Field Interaction with Plasmas***

Organizers: Yasuhiko Sentoku (University Nevada, Reno) and Kunioki Mima (Osaka University)
Location: Kyoto and Osaka, Japan
Dates: April 29-30, 2004

Summary: This US-Japan workshop was held in conjunction with the International Conference on Fast Ignition and High Field Physics (FIHFP) in Kyoto. The workshop shed light on the plasma physics related to fast ignition and other applications of ultra-intense lasers. In particular, the workshop considered the methodology for comprehensive simulation of large-scale relativistic laser plasmas. The workshop consisted of two parts. The first part was held at the FIHFP conference site for the purpose of broad participation and wide-ranging topics in order to overview the present status of relativistic laser plasma physics. The second part of the workshop was held at the Institute of Laser Engineering at Osaka University in order to discuss details of the integrated simulation codes. The total number of participants at the FIHFP conference was about 100. The number of participants in the US-Japan workshop at the conference site was 30, and the number at the second part of the workshop in Osaka was 20. The US and Japanese simulation codes that were compared were PIC, PIC-fluid hybrid, Fokker-Planck, and radiation hydro codes. A highlight of the discussion was an evaluation of the LSP implicit hybrid simulation code from the US. LSP simulations and PIC code simulations find significantly different dynamics for the Weibel instability and its associated electromagnetic turbulence. The importance of this difference will be discussed further at a follow-up workshop, to be held at the University of Texas at Austin in October 2005.

Japan to US:

JF1-07 ***JIFT Steering Committee Meeting***

Organizers: James Van Dam (IFS) and Masao Okamoto (NIFS)
Location: Savannah, Georgia, US
Dates: November 16, 2004

Summary:

This Steering Committee Meeting was held during the APS Division of Plasma Physics annual meeting. The participants at the meeting—four members of the steering committee, six members of the US and Japanese advisory committees, and the current Visiting Professor from Japan—are shown in the photograph below. The status of JIFT activities for 2004-05 was reviewed, and recommendations for next year's activities were discussed.

Participants at the JIFT Steering Committee Meeting (November 2004).
Front row (left to right): J. Leboeuf, W. Horton, P. Terry, B. Cohen, M. Crisp.
Back row: J. Van Dam, J. Manickam, K. Mima, T. Ozeki, R. Horiuchi.
Not shown: S. Ishiguro.

JF1-08 ***Physics of Energetic Particles***
Organizers: Guoyong Fu (PPPL) and Yasushi Todo (NIFS)
Location: Napa, California, US
Dates: April 6-9, 2005
Summary:

This JIFT workshop was held in conjunction with the annual meeting of the US Transport Task Force, in particular, the TTF Fast Particle Working Group. The workshop had 20 participants, including four Japanese scientists, 14 US scientists, and two international scientists. The presentations covered energetic particle confinement and Alfvén eigenmode stability in heliotron, tokamak, spherical torus, and basic laboratory devices. Interestingly, seven of the 20 participants were experimentalists, which contributed to lively discussions about theory, simulations, and experimental results during the workshop sessions. Also, during the plenary session involving all of the TTF working groups, one of the five overview talks was on energetic particle physics. Workshop participants concluded that enhanced efforts on integrated numerical simulations, on pre-ignition experiments that model aspects of alpha particle behavior, and on new fast particle diagnostics are needed in preparation for ITER.

Related publications:

All of the talks will be posted on the workshop web site (to be set up shortly).

JF1-09 ***Theory-Based Modeling and Integrated Simulation of Burning Plasma (II)***
Organizers: Steve Jardin (PPPL) and Atsushi Fukuyama (Kyoto University)
Location: Princeton Plasma Physics Laboratory, Princeton, New Jersey, US
Dates: September 21-24, 2004
Summary:

This, the second JIFT workshop on integrated modeling of toroidal plasmas, followed up on a similar JIFT workshop held last year in Japan. About 30 scientists attended the workshop. There were 16 talks, five from Japanese participants, nine from US participants, and two from European invited participants. The present status of integrated modeling code initiatives in Japan, the US, and Europe was reported. Recent advances in whole-

device modeling efforts, MHD and extended MHD codes, turbulence simulations, edge-plasma integrated modeling, wave-particle interactions, and software infrastructure were presented and vigorously discussed. One conclusion was that an international framework for module and data exchange should be discussed in the near future.

Related publications:

- A. Fukuyama et al., "Advanced Transport Modeling of Toroidal Plasmas with Transport Barriers," in *Proc. of 20th IAEA Fusion Energy Conference 2004* (IAEA, Vienna, 2005), IAEA-CSP-25/CD/TH/P2-3.
- All of the talks at the workshop at available at http://w3.pppl.gov/usjapanim, along with a detailed summary of the workshop.

B. 2004-2005 Exchange Visits

Japan to US:

JF1-10 ***Atomic Processes in Fusion Reactor Edge Plasmas***
Exchange Scientist: Daiji Kato (NIFS)
Locations: Sandia National Laboratory, Albuquerque, New Mexico, US
Dates: February 20-24, 2005 (five days); paid by Japan
Summary:

During this visit, Dr. Kato consulted with host researchers about applications of the quantum molecular dynamics program code VASP to materials studies relevant to plasma-wall interactions in fusion devices. Ab initio studies using the VASP code on electron conductivity of metals at extremely high temperatures (> 10,000 K) were explained. Quantum molecular dynamics is powerful, especially for the study of electronic states of condensed matter under unusual conditions that are inaccessible by conventional techniques such as high temperature, high pressure, radiation, etc. The wall materials for fusion devises will be damaged by high-energy radiation and will be contaminated by impurities. In such disordered systems, particle transport should be very different from that in pure crystalline systems. The particle transport parameters of such disordered systems can be obtained with the use of quantum molecular dynamics, and are of great practical importance for plasma-wall interaction studies of fusion devices. In this visit, Dr. Kato learned how to use the VASP code, and carried out some structural calculations preliminarily for pure graphite crystals and hydrogenated graphite surfaces.

JF1-11 ***Simulation Study of RF Heating and Energetic Particle Transport***
Exchange Scientist: Sadayoshi Murakami (Kyoto University)
Proposed visit: General Atomics; summer 2004 (three weeks); paid by Japan
Status: Deferred

JF1-12 ***Simulation Study of Energetic Particle Driven MHD Modes***
Exchange Scientist: Yasushi Todo (NIFS)
Location: Institute for Fusion Studies, University of Texas, Austin, Texas, US
Dates: March 22, 2005–April 5, 2005 (two weeks); paid by Japan
Research Summary:

Recurrent bursts of toroidicity-induced Alfvén eigenmodes (TAE) were studied with a self-consistent simulation model. Bursts of beam ion losses observed in the neutral beam injection experiments on the Tokamak Fusion Test Reactor were reproduced with the use of experimental parameters. Only co-injected beam ions build up to a significant stored energy, even though their distribution is flattened in the plasma center. In the simulation, the distance to the limiter is decreased after the stored beam energy saturates. It was found that the co-passing beam particles may not readily reach the limiter even if the orbit width of edge-located particles is larger than the outer edge spacing between the limiter and the plasma. The existence of KAM surfaces of the edge mode even at large field amplitudes apparently inhibits energetic co-passing particles from being lost to the limiter.

Related publications:

- Y. Todo, H. L. Berk, and B. N. Breizman; ``Simulation of intermittent beam ion loss in a Tokamak Fusion Test Reactor experiment," Physics of Plasmas, Vol. 10, No. 7 (2003), pp. 2888-2902.
- Y. Todo, H. L. Berk, and B. N. Breizman; ``Energetic ion transport due to Alfvén eigenmode bursts," to be published in Journal of Plasma and Fusion Research SERIES 6.

JF1-13 ***Particle Simulation in Open Systems***
Visiting Professor: Seiji Ishiguro (NIFS)
Location: Institute for Fusion Studies, University of Texas, Austin, Texas, US
Dates: November 8–December 3, 2004 (one month); paid by US
Summary:

Interest is increasing in simulation studies of open systems, such as scrape-off-layer plasmas in magnetic plasma confinement devices and laser-plasma interactions in inertial fusion experiments. Dr. Ishiguro developed a three-dimensional particle-in-cell simulation code for open systems in order to investigate the physics of scrape-off-layer plasmas. He studied the transport and collapse of blobs, which have been observed in recent magnetic plasma confinement experiments and theoretically studied with the two-dimensional fluid model.

JF1-14 ***Large-Amplitude Plasma Waves and Particle Acceleration***
Exchange Scientist: Yukiharu Ohsawa (Nagoya University)
Location: Institute for Fusion Studies and University of California at Los Angeles
Dates: August 3–27, 2004 (one month); paid by Japan
Summary:

Particle acceleration mechanisms for ions, electrons, and positrons in large-amplitude magnetosonic shock waves were studied by means of theory and particle simulations. Simulation methods were also investigated. In particular, in collaboration with Prof. W. Horton at the IFS and Prof. C. Chiu of the Physics Department of the University of Texas, Dr. Ohsawa investigated the acceleration of energetic electrons in a quasi-perpendicular shock wave. It was shown that high-energy electrons with gyroradii greater than the width of the shock transition region can gain energy from the transverse electric field in association with gyromotion.

Related publications:

- C. Chiu, W. Horton, and Y. Ohsawa, "Large acceleration of electrons by the microstructure of quasi-normal shocks," submitted for publication to Physics of Plasmas.

JF1-15 ***Analysis of Stabilities and Waves in Flowing Plasmas***
Exchange Scientist: Makoto Hirota (Tokyo University)
Location: Courant Institute of Mathematical Sciences, New York, New York, US
Dates: September 20–December 18, 2004 (three months); paid by Japan
Summary:

This visit focused on the linear stability of Hall MHD equilibria with flow. The Lagrange representation for linearized Hall MHD equation was worked out with a consideration of special perturbations that preserve certain constants of motion. The resultant equation has a symmetry that enables the energy principle to be applicable. However, the quadratic form is not positive definite in the presence of flow. The dynamically accessible variation that, by definition, preserves all constants of motion was discussed. For such perturbations, the quadratic form can be positive definite. Some conditions were found for which equilibria with flow are stable.

JF1-16 ***Simulation Study of Collisionless Driven Reconnection***
Exchange Scientist: Hiroaki Ohtani (NIFS)
Location: Princeton Plasma Physics Laboratory, Princeton, New Jersey, US
Dates: Nov.13–Dec.12, 2004 (one month); paid by Japan
Summary:

We performed an electromagnetic particle simulation to investigate whole physical picture of collisionless driven reconnection in an open system. Lower hybrid drift wave is excited in the early period, and then low-*n* mode (drift kink mode) is excited in the central region of current sheet in the late period and sustained for a long time. When the drift kink mode is excited, the reconnection electric field is generated in the current sheet, which is balanced with the wave component in the electron force balance equation. On the other hand, it is supported by the off-diagonal component of pressure tensor term for ion. From these results, it is concluded that an anomalous resistivity created by the drift kink instability leads to the violation of frozen-in condition.

Related publications:

- R. Horiuchi, H. Ohtani, and A. Ishizawa, "Structure formation and dynamical behavior of kinetic plasmas controlled by magnetic reconnection," Computer Physics Communications, Vol. 164 (2004), pp. 17-32.

US to Japan:

JF1-03 ***MHD Stability Calculation For LHD***
Exchange Scientist: Benjamin Carreras (ORNL)
Proposed visit: NIFS; December 2004 (two weeks); paid by US
Status: Deferred

JF1-04 ***Analysis of Micro-Instability in LHD and JT-60U Plasmas***
Exchange Scientist: Gregory Rewoldt (PPPL)
Location: NIFS, JAERI, and Earth Simulator Center, Japan
Dates: May 12–May 21, 2004 (10 days); paid by US
Summary:

Using the FULL code, Dr. Rewoldt has been carrying out the linear analysis of micro-instabilities such as ion temperature gradient modes and trapped electron modes in the LHD heliotron and the JT-60U tokamak. Frequencies, growth rates, mode structures, and quasilinear fluxes of particles and energy associated with the microinstabilities were numerically evaluated, and a comparison between the mode properties in helical systems and those in tokamaks was made. During his visit to NIFS, he presented a seminar and held discussions with NIFS scientists concerning micro-instabilities in LHD. Together with collaborators at NIFS, he identified new plasma cases for detailed micro-stability analysis that have high and low transport relative to a new empirical stellarator scaling (ISS04v1). During his visit to the Japan Atomic Energy Research Institute Dr. Rewoldt discussed his JT-60U micro-instability calculations with the FULL code. He described the ongoing development of the GTC code at PPPL and U.C. Irvine, and its comparison with the GT3D code being developed at JAERI. Dr. Rewoldt also visited the Earth Simulator Center in Yokohama, Japan, for informal discussions with its director, Professor T. Sato. He toured the Earth Simulator Computer machine room and the Earth Simulator "cave" for visualization.

Related publications:

- G. Rewoldt, L.-P. Ku, W. M. Tang, H. Sugama, N. Nakajima, K. Y. Watanabe, S. Murakami, H. Yamada, and W. A. Cooper, "Drift mode calculations for the Large Helical Device," Phys. Plasmas, Vol. 7, p. 4942 (2000).
- G. Rewoldt, L.-P. Ku, W.M. Tang, H. Sugama, N. Nakajima, K. Y. Watanabe, S. Murakami, H. Yamada, and W. A. Cooper, "Microinstability studies for the Large Helical Device," Nuclear Fusion, Vol. 42, p. 1047 (2002).

JF1-05 ***Two Fluid Plasma Models With Mass Flow***
Visiting Professor: Eliezer Hameiri (Courant Institute of Mathematical Sciences)
Location: NIFS, Toki, Japan
Dates: June 2–September 2, 2004 (three months); paid by Japan
Summary:

During his visit, Dr. Hameiri conducted research in the area of energy relaxation and self-organization in a macroscopic system with plasma flow. Working with two Japanese collaborators, he investigated the waves that are present in the Hall-MHD model, which describes a two-fluid plasma with negligible electron mass. The three normal-MHD waves were followed as they transition under the influence of an increasingly strong Hall current effect to the characteristic waves of the Hall-MHD model. Geometric optics was used to obtain wave solutions for general equilibria. This allowed the ray surfaces (approximating the wave fronts) of these waves to be followed. The significant changes in the nature of these waves were described analytically and numerically. Most notably, the incompressible MHD shear Alfvén wave turns into a compressible fluid-dynamical wave with negligible perturbation of the electromagnetic field. This work was submitted for publication to Physics of Plasmas. Dr. Hameiri also addressed the related problem of "contact discontinuity" in Hall MHD, i.e., what shocks and discontinuities can be allowed by in this model. A paper on this work will be submitted for publication shortly. Dr. Hameiri also briefly visited Niigata University, Osaka University, and Tokyo University to discuss recent research results.

Related publications:

- E. Hameiri, A. Ishizawa, and A. Ishida, "Waves in the Hall-Magnetohydrodynamics Model," submitted for publication to Physics of Plasmas

- E. Hameiri, "Linear Stability of a Hall-MHD Equilibrium with Discontinuity," to be submitted for publication

JF1-06 ***MHD Theory on the Resistive Wall Mode***
Visiting Professor: Ming-Sheng Chu (General Atomics)
Location: NIFS, Toki, Japan
Dates: September 1–November 30, 2004 (three months); paid by Japan
Summary:

The resistive wall mode (RWM) can be destabilized even in helical plasmas, when a large net toroidal current is induced and the external kink mode is destabilized. During his stay at NIFS, Dr. Chu evaluated the RWM growth rate for LHD plasmas, in collaboration with Dr. Ichiguchi. Instead of relying on the variation principle method, they developed a simplified approximation method to obtain the growth rate. The method was applied for the KSTEP code developed by Dr. Ichiguchi. They found quantitatively that the RWM is destabilized in LHD when the net toroidal current is sufficiently large, although its growth rate is much smaller than that of the ideal external kink mode, much like in the tokamak case.

Related publications:

- M. S. Chu and K. Ichiguchi, "Effect of the Resistive Wall on the Growth Rate of Weakly Unstable External Kink Mode in General 3D Configurations," to be published in Nuclear Fusion (2005).

C. 2004-2005 Joint Computational Projects

The following eighteen JIFT joint computational projects on various topics were also active during the past year.

JF2-01 ***Large Scale Simulation on Helical Plasma Physics***
K. Ichiguchi, T. Hayashi, N. Nakajima (NIFS);
B. Carreras (ORNL); L. Sugiyama (MIT); S. Hudson (PPPL)

JF2-02 ***Development of a Numerical Analysis Method of the Drift Kinetic Equation by Monte Carlo Method***
S. Murakami (Kyoto U.);
V. S. Chan, M. Choi, L. Lao (GA)

JF2-03 ***Physics of Energetic Particles in Fusion Plasmas***
Y. Todo (NIFS);
H. L. Berk, B. N. Breizman, J. W. Van Dam (IFS)

JF2-04 ***Particle Simulation in Open Systems***
S. Ishiguro, R. Horiuchi, H. Ohtani (NIFS);
J. N. Leboeuf, V. K. Decyk (UCLA)

JF2-05 ***Drift Mode Analyses for the Large Helical Device***
N. Nakajima, H. Yamada (NIFS);
G. Rewoldt, G. Y. Fu (PPPL)

JF2-06 ***Gyrokinetic Transport Simulation***
V. Decyk, R. Sydora (UCLA); W. Lee (PPPL);
T. Takayama (NIFS); H. Naitou (Yamaguchi)

JF2-07 ***Plasma Rotation, Vortices, and Anomalous Transport***
W. Horton, A. Aydemir (IFS); B. Carreras (ORNL);
M. Okamoto, H. Sugama (NIFS); S. Murakami (Kyoto)

JF2-08 ***MHD Stability in Advanced Tokamaks***
M. Ozeki, Y. Ishii (JAERI), Y. Tomita (NIFS);
J. Manickam (PPPL); A. Aydemir (IFS)

JF2-09 ***New Simulation Algorithms for Massively Parallel Processing***
V. Decyk (UCLA); W. Tang (PPPL);
K. Watanabe, R. Horiuchi, S. Ishiguro (NIFS)

JF2-10 ***Toroidal Simulation and Plasma Transport Modeling***
W. Horton (IFS);
Y. Kishimoto, A. Azumi (JAERI); H. Takamaru (NIFS)

JF2-11 ***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)

JF2-12 ***Turbulent Transport Applications to Tokamaks and Helical Systems***
B. Carreras (ORNL); W. Horton (IFS);
Y. Nakamura (Kyoto); M. Yokoyama (NIFS)

JF2-13 ***Tokamak Simulation on Massively Parallel Computers***
B. Carreras, D. Spong (ORNL); J.N. Leboeuf, V. Decyk (UCLA);
S. Tokuda, F. Kurita (JAERI); T. Watanabe (NIFS)

JF2-14 ***MHD and Transport Phenomena in Toroidal Systems***
W. Tang, G. Rewoldt, C.Z. Cheng (PPPL);
H. Sugama, R. Ishizaki (NIFS)

JF2-15 ***Kinetic Effects on MHD Phenomena***
J. Van Dam, H. Berk (IFS);
M. Okamoto, N. Nakajima, K. Ichiguchi (NIFS)

JF2-16 ***Large Scale Simulation on Helical Plasma Physics***
K. Ichiguchi, T. Hayashi, N. Nakajima (NIFS);
B. Carreras (ORNL); L. Sugiyama (MIT); S. Hudson (PPPL)

JF2-17 ***Particle Simulation in Open Systems***
S. Ishiguro, R. Horiuchi, H. Ohtani (NIFS);
J. N. Leboeuf, V. K. Decyk (UCLA)

JF2-18 ***Benchmarking Kinetic Stability Code for Toroidal Devices***
G. Rewoldt (PPPL);
Y. Idomura (JAERI), A. Fukuyama (Kyoto)

3. *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 associate director of the Institute for Fusion Studies (IFS) of The University of Texas at Austin. The Japanese co-chairman is the director of the Theory and Computer Simulation Center at the National Institute for Fusion Studies, and the Japanese co-executive secretary is currently director of the Computer and Information Network Center. 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	*Japanese Members*
J. Van Dam (IFS)—Co-Chairman	M. Okamoto (NIFS)—Co-Chairman
F. Waelbroeck (IFS)—Co-Exec. Secretary	R. Horiuchi (NIFS)—Co-Exec. Secretary
J. Leboeuf (UCLA)	Z. Yoshida (Tokyo)
M. Crisp (DOE)	K. Mima (Osaka)

JIFT Advisors

Japanese Advisor: T. Ozeki (JAERI)

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

The JIFT Steering Committee attempts to schedule workshops in such a way as to dovetail with other meetings. It also encourages participation at workshops by interested experimentalists and invites 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.

Note that information about the JIFT program, including annual schedules of exchange activities, can be found on the new JIFT web site at http://peaches.ph.utexas.edu/jift/.

4. *OTHER INFORMATION*

The proceedings of the JIFT workshop on "Scope of Simulation Science" (JF1-05), which was held during the previous year's schedule (September 7-10, 2003, Falmouth, MA) in conjunction with the 18th International Conference on the Numerical Simulation of Plasmas, have been published as a special issue of *Computer Physics Communications Journal* (Vol. 164/1-2, December 2004, edited by O. Batishchev). This issue contains 74 contributed papers, a preface dedicated to the memory of Prof. John M. Dawson (former long-time JIFT steering committee member), and information about the winners of the John Dawson Prize, the Oscar Buneman Best Visualization Awards, and the Best Student Presentation Awards.

Collaborative research related to several recent JIFT workshops and exchange visits—viz., the workshop on "Structural Formation and Drift Wave/MHD Turbulence (Kyushu University, September 11-13, 2003); the workshop on "Structure Formation in Plasma and Fluid Turbulence" (University of California at San Diego, September 18-25, 2003); and the exchange visits on "Study on the Zonal Flow Effect on Plasma Microturbulence" by Dr. Masatoshi Yagi (to UCSD and PPPL, January 26–February 2, 2003, and January 25–February 1, 2004)—has led to the publication of a large review paper entitled "Zonal Flows in Plasma—A Review" by P. H. Diamond, S.-I. Itoh, K. Itoh and T. S. Hahm, in *Plasma Physics and Controlled Fusion*, Vol. 47, pp. R35-R161 (2005). Furthermore, the same collaborative research was reported at the 2004 IAEA Fusion Energy Conference (Vilamoura, Portugal, November 1-6, 2004) in an invited overview talk [P. Diamond, "Overview of Zonal Flow Physics," paper OV-2/1]. It is noteworthy that this was the first-ever overview talk about theory in the history of this prestigious conference.

Members of the JIFT Steering Committee were involved in publishing an obituary about Prof. Masahiro Wakatani, former long-time steering committee member [S. Hamaguchi, A. Hasegawa, and J. W. Van Dam, "Masahiro Wakatani," *Physics Today*, pp. 91-92 (November 2003)]. Also in Wakatani's memory, three special invited talks were given at the 13th International Toki Conference on Plasma Physics and Controlled Nuclear Fusion (ITC13). These talks were subsequently published in the proceedings of this conference [A. Iiyoshi, "Reminiscences of Professor Masahiro Wakatani", pp. 97-99; J. W. Van Dam and W. Horton, "The Legacy of Masahiro Wakatani," pp. 100-106; and B. Carreras, "Contributions of Masahiro Wakatani to the Study of MHD Properties of Magnetically Confined Plasmas and to the Understanding of Helical Systems," pp. 107-111; all published in the *Journal of Plasma and Fusion Research Series*, Vol. 6, "Proceedings of 13th International Toki Conference on Plasma Physics

and Controlled Nuclear Fusion (ITC13): Progress in Plasma Theory and Understanding of Fusion Plasmas, Dec. 9-12, 2003, Toki, Japan," edited by K. Ichiguchi, M. Yokoyama, and T. Hayashi].

5. *PLANS FOR FUTURE ACTIVITIES (PROPOSED 2005-2006 PROGRAM)*

The topics and themes of the exchange activities that have been proposed for the next year (April 1, 2005–March 31, 2006) 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 (2005-2006) is listed below.

A. 2005-2006 Proposed Workshops

US to Japan:

New Development of Simulation Science
Organizers: Ritoku Horiuchi (NIFS) and Oleg Batishchev (MIT)
Proposed Place/Time: Nara, Japan; July 2005 (to be held in conjunction with the 19th International Conference on the Numerical Simulation of Plasmas)

Integrated Modeling of Multi-Scale Physics in Fusion Plasmas
Organizers: Atsushi Fukuyama (Kyoto) and Steven Jardin (PPPL)
Proposed Place/Time: Kyushu University, Japan; September 2005

JIFT Steering Committee Meeting
Organizers: Masao Okamoto (NIFS) and James Van Dam (IFS)
Proposed Place/Time: NIFS, Japan, November 2005

Japan to US:

Issues in Theoretical Analyses for Three Dimensional Configurations
Organizers: Donald Monticello (PPPL) and Noriyoshi Nakajima (NIFS)
Proposed Place/Time: PPPL, NJ; January 2006

Theory and Simulation on Ultra-Intense Laser Plasmas
Organizers: Gennady Shvets (IFS) and Kunioka Mima (Osaka)
Proposed Place/Time: University of Texas, Austin, TX; October 2005

B. 2005-2006 Proposed Exchange Visits

Japan to US:

Direct Numerical Simulation of MHD in LHD
Hideaki Miura (NIFS), Visiting Professor
IFS; November-December 2005 (six weeks); paid by US

Simulation Study of RF Heating and Energetic Particle Transport
Sadayoshi Murakami (Kyoto), Visiting Scientist
General Atomics; July 2005 (3 weeks); paid by Japan

Simulation Study of Kinetic MHD Modes by Using a New Gyrokinetic Particle Code
Hiroshi Naitou (Yamaguchi), Visiting Scientist
PPPL; August 2005 (three weeks); paid by Japan

Nonlinear MHD Analysis of LHD Plasmas
Katsuji Ichiguchi (NIFS), Visiting Scientist
ORNL; June 2005 (three weeks); paid by Japan

US to Japan:

Fluid Closure Models and Application in Low Collisionality Plasma Regimes
Jesus Ramos (MIT), Visiting Professor
NIFS; June–September, 2005 (three months); paid by Japan

MHD Stability Calculations for LHD

Benjamin Carreras (ORNL), Visiting Scientist
NIFS; December 2-15, 2005 (two weeks); paid by US

C. 2005-2006 Proposed Joint Computational Projects

Large Scale Simulation on Helical Plasma Physics
K. Ichiguchi, T. Hayashi, N. Nakajima (NIFS);
B. Carreras (ORNL); L. Sugiyama (MIT); S. Hudson (PPPL)
1 week; 1 person to US

Development of a Numerical Analysis Method of the Drift Kinetic Equation by Monte Carlo Method
S. Murakami (Kyoto);
V. S. Chan, M. Choi, L. Lao (GA)
1 week; 1 person to US

Computer Simulation of Alfvén Eigenmode Bursts
Y. Todo (NIFS);
H. L. Berk, B. N. Breizman, J. W. Van Dam (IFS)
1 week; 1 person to Japan

Particle Simulation in Open Systems
S. Ishiguro, R. Horiuchi, H. Ohtani (NIFS);
J. N. Leboeuf, V. K. Decyk (UCLA)
1 week; 1 person to Japan

CONTINUED FROM 2004-05:

Drift Mode Analyses for the Large Helical Device
N. Nakajima, H. Yamada (NIFS);
G. Rewoldt, G. Y. Fu (PPPL)
1 week; 1 person to Japan, continued from 2004-2005

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 2004-2005

Plasma Rotation, Vortices, and Anomalous Transport
W. Horton, A. Aydemir (IFS); B. Carreras (ORNL);
M. Okamoto, H. Sugama (NIFS); S. Murakami (Kyoto)
3 weeks; 1 person to Japan; continued from 2004-2005

MHD Stability in Advanced Tokamaks
M. Ozeki, Y. Ishii (JAERI); Y. Tomita (NIFS);
J. Manickam (PPPL); A. Aydemir (IFS)
1 week; 1 person to US, continued from 2004-2005

New Simulation Algorithms for Massively Parallel Processing
V. Decyk (UCLA); W. Tang (PPPL);
K. Watanabe (Earth Simulator); R. Horiuchi, S. Ishiguro (NIFS)
2 weeks; 1 person to US; continued from 2004-2005

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 2004-2005

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 2004-2005

Turbulent Transport Applications to Tokamaks and Helical Systems
B. Carreras (ORNL); W. Horton (IFS);
Y. Nakamura (Kyoto); M. Yokoyama (NIFS)
1 week; 1 person to US; continued from 2004-2005

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 2004-2005

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 2004-2005