National Institutes of Natural Sciences

National Institute for Fusion Science

Peer Review Reports for FY2015

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National Institute for Fusion Science

Advisory Committee External Peer Review Committee

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Chapter 1 Background

The National Institute for Fusion Science (NIFS) was established in 1989 as an inter-university research institute in order to promote fusion science research at universities through using the Large Helical Device (LHD) as the principal experimental device. The LHD, which was designed with the collective opinion and the expectations of the fusion community, has the special characteristic of generating the heliotron-type magnetic field, which is an idea unique to Japan, by superconductive coils. And together with producing high-performance plasma through the helical method via high-power heating, we are advancing with experimental research that aims to clarify physical and engineering issues related to realizing the toroidal magnetic field confinement fusion reactor. On the other hand, parallel to this, in the analysis of essentially complicated fusion plasma, theoretical research utilizing large-scale simulations is indispensable. At the National Institute for Fusion Science we have introduced the cutting edge supercomputer (Plasma Simulator) for exclusive use. And by providing collaborative use to fusion theory researchers in Japan we are advancing with pioneering research.

During this time, there have occurred changes in the system for academic research in Japan. From 2004, the National Institute for Fusion Science, as a member of the Inter-University Research Institute Corporation National Institutes of Natural Sciences, pushed forward with joint use and joint research projects. In having become a corporation, six-year mid-term goals and planning were introduced, and a new system by which the Institute would undergo an annual evaluation regarding progress was implemented. This annual evaluation focuses principally upon administrative management, but at the National Institute for Fusion Science it was determined that receiving evaluations from external experts regarding research results is important. The National Institute for Fusion Science organized the external peer review committee under the Advisory Committee, and is now conducting research evaluations annually. The topics for evaluation are decided upon at the Advisory Committee, and the External Peer Review Committee is organized, which is composed of external members of the Advisory Committee and external experts in the topics to be evaluated. The External Peer Review Committee reports the evaluation results to the Advisory Committee, and the National Institute for Fusion Science, respecting those results, utilizes them in improving the research activities from the following year.

At the National Institute for Fusion Science, upon the beginning of the second period for mid-term plan that began in 2010, in order to strengthen further the centripetal power of the National Institute for Fusion Science as a recipient of a Center of Excellence grant (COE) in the field of plasma fusion research, we have started research planning in three research projects, LHD, the

Numerical Simulation Reactor Research, and Fusion Engineering Research. These projects will unify results to date that focus on realizing the fusion reactor. For this purpose, in 2010 we undertook an internal reorganization of the research structure. In addition to incorporating all research and education staff into one research department, a system which permitted personal choice of participation in a research project was introduced. From this, the cooperation among the three projects of LHD, the Numerical Simulation Reactor Research, and Fusion Engineering Research became much stronger, and we became more flexible in responding to new topics.

At the Advisory Committee, in order to confirm the results of the project system, the external evaluations were conducted first in 2011 for the LHD Project, in 2012 for the Numerical Simulation Reactor Research Project, in 2013 for the Fusion Engineering Research Project, and then in 2014 for the Deuterium Experiment Implementation Plan. Then, in 2015, under the subject "Numerical Simulation Reactor Research Project" the external peer review was undertaken. Then, as external peer review committee members, ten external members of the Advisory Committee and three foreign researchers were appointed, and, further, five domestic experts and two foreign experts from outside the National Institute for Fusion Science were added. Thus was composed the external evaluation committee, and this committee undertook the work of evaluation.

On October 21, 2015, at the First External Peer Review Committee and Experts Committee Meeting there was consultation regarding how to proceed with this year's external peer review. There the issues for evaluation as well as the specific items for evaluation were decided. Those details are found at the end of this chapter. At the Second External Peer Review Committee and Experts Committee Meeting, which was held on November 28, 2015, the responsible leaders of the National Institute for Fusion Science gave the committee members a detailed explanation by utilizing viewgraphs and activity report documents (consult the Documents above) treating these points of evaluation as well as evaluation topics. A question and answer session followed. Subsequently, on January 20, 2016, the Third External Peer Review Committee and Experts Committee Meeting was held~~,~~. Further discussion was held on evaluations that followed the points and items that had been decided by the External Peer Review Committee and the Experts Committee, and their compilation was undertaken. As a result, because a general agreement had been achieved regarding the fundamental conclusions to be drawn from the results of the external peer review, subsequently the final report was compiled through an email discussion.

This report is composed of the following three chapters: "Chapter 1 Background," "Chapter 2 Summary of Evaluations, and Proposals," and "Chapter 3 In Closing."

After submission to the National Institute for Fusion Science Advisory Committee Meeting and its approval, the report was submitted by the Director General of National Institute for Fusion Science to the President of the National Institutes of Natural Sciences. Subsequently, the report will be submitted to the National Institutes of Natural Sciences Education and Research Council and Administrative Council, and after being approved the report is planned to be reference material for “Report of Administrative Achievements during the Business Year 2015” and “National Institutes of Natural Sciences Annual Plan (2016).” This report will be made publicly available as a printed text and as a homepage text.

The points for evaluating the “Numerical Simulation Reactor Research Project” are composed of the essential points for evaluation of the “Numerical Simulation Reactor Research Project” advanced by the National Institute for Fusion Science which is listed in the mid-term plan determined by the National Institutes of Natural Sciences, and will be the base of the achievement evaluation and the research level evaluation.

Further, based upon the proposal in the “External Peer Review Regarding the Numerical Simulation Reactor Research Project” conducted in 2012 we will consider in this evaluation the following points.

1. Is research for the purpose of clarifying the physical mechanisms of fusion plasma confinement and its systematization, and also for constructing a numerical test reactor, advancing?
2. Is the Project advancing closely as a joint project with the Large Helical Device Project and the Fusion Engineering Research Project? Is the approach advancing concretely, for example, by constructing the road map for the numerical test reactor?
3. Is enhanced performance of the plasma simulator being achieved, and strengthening of the research base and improvement of computational science advancing?
4. Are young researchers who will be responsible for simulation research and numerical science being nurtured? Further, is the Project continuing to actively contribute to ITER project and to BA activities?

The evaluation topics for the “Numerical Simulation Reactor Research Project,” which was implemented this year, are as below.

[1] Development of Research System and Environment

(1) Does the research system function appropriately in accomplishing the objectives of the Numerical Simulation Reactor Research Project (NSRP)?

(2) Is the environment of the “Plasma Simulator” system and its related research developed appropriately? Is the “Plasma Simulator” effectively utilized for collaboration research?

[2] Research Achievements

Does the NSRP produce high-level achievements in accordance with international standards for the following research areas by promoting theory and computer simulation research utilizing the Plasma Simulator?

(1) Construction of the Numerical Test Reactor for a helical fusion system

(2) Physics mechanisms of fusion plasmas and their theoretical systemization

[3] Promotion of Cooperation and Collaboration

(1) Does the NSRP promote collaboration research as the center of excellence by integrating the high capabilities of universities and institutes?

(2) Does the NSRP contribute to the development of research in universities?
Does the NSRP function as a research hub for the dissemination of academic information to other fields?

(3) Does the NSRP promote international cooperation through contributions to ITER, BA activities, and other international collaborations?

[4] Human Resources Development

(1) Does the NSRP contribute to the development of human resources for the international scientific workforce required for long-term fusion science through simulation research?

[5] Future Planning

(1) Is the NSRP research plan for progressing toward the realization of the objectives appropriate? Is the research plan suitable for the next decade?

Chapter 2 Summary of Evaluations, and Proposals

Based upon the External Peer Review Committee's discussions we summarized the important points of evaluation, and here offer several important proposals regarding the advancement of the Numerical Simulation Reactor Research Project.

1. Summary of Evaluations

[1] Development of research system and environment

(1) Does the research system function appropriately in accomplishing the objectives of the Numerical Simulation Reactor Research Project (NSRP)?

The structure of organic cooperation under which this Numerical Simulation Reactor Research Project is being conducted together with the LHD Project, as well as the Fusion Engineering Research Project is appropriate. And regarding the broad-ranging physical topics of helical plasma, research activities through various facilities are advancing together with flexibility and motility as is seen in the eight-task group system and the linkages among task groups, which is the research matrix of this project. And a research structure for developing and improving world-leading simulation codes is being constructed. That this is functioning organically is highly evaluated.

However, considered from the perspective of "Has the establishment of goals that each group should respectively achieve and the evaluation of the levels of achievement been satisfactorily implemented?", strengthening of the system for checking the degree of advances regarding the overall development goals, the securing of researchers who will undertake management that will give birth to synergistic results from the links among research groups, and the balance of the number of researchers, consideration of points arising from the project management likely will be necessary. At the same time, it will be necessary for each research group to be aware of the goals of the project.

From the perspectives of cross-disciplinary linkages as well as the inter-university research institute, as the warp and the woof of the project's propulsion and academic development we hope that this will support and develop research structures in which researchers contribute to both the advancement and the academic development of the projects.

(2) Is the environment of the "Plasma Simulator" system and its related research developed appropriately? Is the "Plasma Simulator" effectively utilized for collaboration research?

For the introduction of our country's third-ranked supercomputer, the preparation of related research environments are advancing appropriately. Further, we can extremely highly evaluate the new research results of exceptional quality that are emerging. We may greatly expect research developments in the future. Accordingly, the way of advancing with current research, and the preparation and management of the environment are appropriate. And that this is effectively functioning well can be evaluated. Further, not only the management of the supercomputer and its usage, but also regarding the introduction of new machines, the parallelization of varieties of code and the support of speeding-up that have been developed in this project, the holding of open lectures, various efforts for enhancing services on the National Institute for Fusion Science Webpage for the convenience of users have occurred. This is highly evaluated.

Utilizing the environment that has been prepared under this project, more than fifty projects have been effectively performed. And every year more than 15,000 individual jobs have been performed, and the average operation rate is 90%. Regarding the rate of utilization, too, this is highly evaluated. Further, we evaluate the development of virtual reality-related tools that are aimed toward the visualization of simulation results. In the future, in order to advance research results still further, in addition to anticipating their efficient use, we anticipate disseminating the results to the public.

On the other hand, in the operation of the numerical simulation reactor research project, in addition to further clarifying expected indicators for measuring the degree of development by utilizing the computational ability to be prepared, while constructing improvement plans that counterbalance targets step by step, please advance further. In the case of aiming for the best conditions amid limited resources, with regard to the development of elements in which development is advancing slowly, environment improvement which enhances calculation time and priorities is necessary, and regarding the conditions of the progress of each group in the complete plan is necessary.

[2] Research achievements

Does the NSRP produce high-level achievements in accordance with international standards for the following research areas by promoting theory and computer simulation research utilizing the Plasma Simulator?

(1) Construction of the Numerical Test Reactor for a helical fusion system

An important physical mechanism for determining plasma stability that is essential for fusion plasma confinement, interaction with high energy particles, edge plasma behavior analysis and

interaction with the wall surface, verification of gyro-kinetic turbulence transport in devices such as the LHD, and the further integration of analysis codes are being steadily developed regarding individual topics. That the goals for the Numerical Simulation Reactor Research for the second mid-term period have been achieved in general is evaluated. At the same time, that international collaboration research is advancing and internationally high level research is being accomplished are extremely highly evaluated. The training and the activities of young researchers too are highly evaluated.

That the modularization of each variety of code that is considered in the application toward experiment analysis, the development of code while being aware of its easy use, the comparison and the verification of experimental results, and benchmarks through international collaboration research activities will be thought to be all the more important in the future, we anticipate still further progress.

On the other hand, the fundamental policy for the construction of the Numerical Test Reactor does not seem to be clear. Considering both the perspective from plasma physics as represented in the next section and the perspective of the reactor core design, we would like to see that the path toward the numerical test reactor construction aimed at by this project should be made clearer through organically unifying further the numerous codes that have been developed. On this occasion, bringing the roadmap into view showing that the integration will be completed after completion of development of all elements, as already one part seems to be beginning at present, the project members should quickly plan the strengthening of the system and prepare research plans that consider integration of each developmental element at all times.

(2) Physics mechanisms of fusion plasmas and their theoretical systemization

From analysis that utilized various types of codes which have been developed, the Project contributes greatly to clarification of the structures of important physical phenomena from the reactor core plasma to the wall, including results that link to analyses of actual LHD experimental results and to the FFHR design, the results of “Clarification of the Physical Structure of Fusion Plasma” developed by each task group can be extremely highly evaluated. At the same time, simulation calculations are contributing greatly to clarifying physical mechanisms with regard to results gained from consistency with theoretical predictions and from experiments. Further, new developments in theoretical systemization are seen, and that numerous research results bearing impact are appearing is worthy of evaluation. Through this project, researchers are spurring on other researchers and active research is being undertaken and appearing in tangible forms. Positive feedback is occurring, and the emergence of still further research results is anticipated.

While fundamental research parts that underlie this project are being appropriately

supported, that the project's contributions to plasma science are being greatly achieved is evaluated highly. In particular, that magnetic reconnection and the analysis of the Rayleigh-Taylor instability are providing results that contribute to our understanding of the fundamental theory of plasma should be specially noted.

In addition, that academic results are appearing not only as academic knowledge, but are also gracing the covers of academic journals as images with impact utilizing visualizations of devices, can be evaluated for spreading this project's presence in Japan and abroad. In the future one anticipates further contributions through international journals.

On the other hand, regarding computer simulations, the development of numerical simulation methods is important. And in the past, in view of the fact that from the field of fusion, too, were proposed many new numerical simulation methods, from now, all the more, in addition to pouring efforts into the field of numerical simulation methods, we anticipate the emergence of new methods from the world of fusion.

[3] Promotion of cooperation and collaboration

(1) Does the NSRP promote collaboration research as the center of excellence by integrating the high capabilities of universities and institutes?

In the mathematical structure and the numerical calculation methods of simulation in the plasma and fusion fields are many points of similarity. This knowledge and experience is shared among researchers, and the effort for the vitalization of research interaction is highly evaluated. Further, it is evaluated that through theoretical collaboration research and Plasma Simulator collaboration research the Project contributes to theory aimed at clarification of physical mechanisms of fusion plasma at universities, and from the delivery of numerous results research developments appropriate to a Center of Excellence are advancing. Moreover, as is seen in the fact that integrated research is being undertaken by using transport codes developed at universities as a base, and turbulence transport codes are developed at the National Institute for Fusion Science, and high energy particle and MHD codes are being utilized for ITER and JT-60SA research, that cooperation among universities and independent administrative agencies is steadily proceeding, too, is evaluated.

On the other hand, despite the fact that research is advancing, that the number of collaboration research projects is nearly constant raises the worry that the number of researchers involved in collaboration research has settled. We anticipate efforts being made in the education of participating researchers and in advertising their activities.

(2) Does the NSRP contribute to the development of research in universities?
Does the NSRP function as a research hub for the dissemination of academic information to other fields?

Not limited to the field of fusion simulation, the Project is contributing to advancing interaction among researchers in the broad basic sciences and to creating new academic fields, is developing new simulation codes and undertaking analyses by establishing links between technical colleges and universities, and is contributing greatly to research development at technical colleges and universities. This is highly evaluated.

Advances in understanding the various structural formations and dynamics inside a small-scale dissipative plasma, such as two-fluid MHD simulation research and turbulence simulation research which includes electron system dynamics and electromagnetic modes, are proceeding. That the Project is producing competitive research results with other fields and is obtaining results spanning various fields seen in collaboration research within the National Institutes of Natural Sciences is highly praised.

On the other hand, it is necessary to heighten still further dissemination strength toward broad areas that include other academic disciplines and industry. From the complication of phenomena that accompanies the improvement of modeling integration and hierarchy, regarding the construction of the Numerical Test Reactor as warp and the fundamental research constructing the universality of theory as woof, it is desired that the Project makes effort in improving cooperation that will strengthen competitive power in communicating with other fields, and together with this we wish to anticipate that the understanding of still more researchers and students will deepen, looking toward the creation of new academic areas through academic activities and undertaking broader and stronger dissemination activities.

(3) Does the NSRP promote international cooperation through contributions to ITER, BA activities, and other international collaborations?

In addition to contributions to BA activities, which are the core of the IFERC activities, and contributions to the ITER project through participating in ITPA, through international cooperation such as Japan-United States cooperation, which for many years has focused on JIFT, Japan-Europe, Japan-People’s Republic of China-Republic of Korea, and Japan-Republic of Korea, the broad contributions to international cooperation are highly evaluated. Further, that the Director of the Rokkasho Research Center concurrently serves as the head of IFERC, and that among the Japan-Europe implementation bodies smooth activities are being actively conducted are evaluated.

Because the expansion of international cooperation is contributing greatly to the promotion of this project, together with fulfilling the principal contributions to the LHD deuterium experiment research and to the helical-type fusion reactor research, we wish to see still further promotion of international cooperation, including contributions to ITER and BA activities.

[4] Human resources development

(1) Does the NSRP contribute to the development of human resources for the international scientific workforce required for long-term fusion science through simulation research?

Every year graduate students enroll in Sokendai and receive education. The Project contributes to the development of human resources, and contributes broadly to the development activities for students in the sciences and mathematics such as SSH activities. Further, that the education activities for graduate students through the summer school program for students in Japan and the winter school program for graduate students from other Asian countries are being undertaken is evaluated. Further, in this project, numerous graduate students and post-doctoral students are being supported, and as a result they are contributing to the publication of academic articles and presentations at international conferences. We highly evaluate that development of young researchers is being undertaken appropriately.

On the other hand, regarding the development of graduate students and young researchers, in observing the future importance of the simulation field, the quality of the students is sufficient but their numbers are rather few. While the importance of simulation research in DEMO reactor design will continue to grow, on the other hand there is worry that there will be few people. As a DEMO reactor design, we anticipate clarification of its position with regard to the important simulation fields, and efforts to organize the development of human resources for the promotion of simulation research.

Moreover, in the petaflops-level simulation that may be developed, accompanying the development of the massively parallel computer, this will necessitate the use of high-level specialized knowledge. In the future, in order to achieve results in large-scale simulations for plasma and fusion research that will be competitive with other fields, it is indispensable that young researchers receive appropriate education and training, and we anticipate the organizational response.

[5] Future plans

(1) Is the NSRP research plan for progressing toward the realization of the objectives appropriate? Is the research plan suitable for the next decade?

Among many topics, there were many advances that should be seen in the utilization of simulations for effective tools in order to analyze and interpret the LHD experimental results. In the third mid-term plan, the view that simulation will proceed more to joint-type is in an appropriate direction, and further advances are anticipated.

On the other hand, the definition of the numerical test reactor is not clear. Further, it cannot be said that the procedure for integration is clearly expressed. Examination of the current plan is necessary. Regarding the Numerical Test Reactor, simulations with several analysis levels from the accurate and large-scale simulation, to mid-scale simulation which will be utilized for the experimental analysis, and to small-scale simulation which will be utilized in the reactor design. Because of this it will be necessary to develop strategic simulation research that clarifies its object.

Regarding the supercomputer, which is indispensable for integration, in order to be able to contribute to the further development of plasma and fusion research, the introduction of a still higher-performance supercomputer will be actively promoted.

2. Proposals

In this current evaluation, resulting from discussions regarding the Numerical Simulation Reactor Research Project, proposals regarding a future path forward are summarized below.

(1) Clarify more clearly the final goals of the entire project “Numerical Simulation Reactor Research Project,” and have them in common in each research group, and strengthen the check system regarding the degree of advancement of a research group’s goals. In addition, it is necessary to consider the management to produce the results due to synergistic effects from the links between research groups.

(2) While placing in view the roadmap which integration will complete finally, strengthening the preparation and the system of the research plans that have always been aware of the combination and integration of each development element should be quickly undertaken.

(3) Regarding the preparation of the Plasma Simulator and the related research environment, we anticipate a preparation plan that inspects the condition of the progress of each group within the overall plan and that follows the stage-by-stage achievement goals that take account of the condition of the progress. In particular, regarding the supercomputer, which is indispensable for integration, we hope into the future for the active promotion of the introduction of a supercomputer of still higher performance to contribute to further development of plasma and fusion research.

(4) Considering the project’s promotion as the warp and the academic development as the woof, together with supporting and developing a research system in which relevant researchers contribute to both and, in addition, promoting international contributions that include collaboration research, we hope to advance further competitive strength that can be extended to various other fields and to advance the creation of new academic research areas through multi-disciplinary activities.

(5) And also for maintaining simulation research activities important for development of the fusion reactor with high standards that will continue into the future, we anticipate undertaking efforts together with universities and other organizations toward systemizing human resource development that will enrich quality and quantity.

Chapter 3 In Closing

At the National Institute for Fusion Science, upon the beginning of the second mid-term goals period from 2010, in order to strengthen still further the centripetal force as a Center of Excellence in the plasma and fusion fields, the National Institute for Fusion Science composed research projects in the three fields of LHD, numerical simulation reactor research, and nuclear fusion engineering research. Aiming toward realization of the fusion reactor, the National Institute for Fusion Science initiated research plans that will integrate these results. For that reason, in 2010 restructuring of the research organization, too, was undertaken. All research staff were organized into one research department, a system that allowed each researcher to freely select participation in three projects was introduced, and links among the three projects, LHD, Numerical Simulation Reactor Research, and Nuclear Fusion Engineering Research, were promoted. And regarding issues, the ability to respond according to circumstances is anticipated.

At the National Institute for Fusion Science Advisory Committee, first, in 2011 the LHD Project, in 2012 the Numerical Simulation Reactor Research Project, in 2013 the Nuclear Fusion Engineering Research Project, and in 2014 the Deuterium Experiment Implementing Plan, underwent external peer reviews, respectively. Then, in this current year, 2015, an external peer review of the “Numerical Experiment Reactor Research Project” was undertaken. As members of the external peer review committee, there are 10 outside members of the Advisory Committee and three foreign members. Further, five members from outside the National Institute for Fusion Science who are specialist researchers and two foreign specialists were added, and these persons composed the external peer review committee, and they undertook their evaluation.

At the First External Peer Review Meeting and the Specialists Meeting held on October 21, 2015, there was discussion regarding how to advance with this year’s external peer review, and it was decided to evaluate the points below.

[1] Preparation of the Research System and the Research Environment

(1) In undertaking the Second Mid-term Plan and Mid-term Objectives, did the research system function appropriately?

(2) Is preparation of the Plasma Simulator and the related research environment being advanced appropriately? Further, is it being utilized effectively?

[2] Research Results

In advancing with theoretical simulation research that utilized the Plasma Simulator, for the two

fields below listed in the second mid-term plan, are results of high international standards being achieved?

(1) Construction of the Numerical Test Reactor

(2) Clarification of the physical mechanisms of fusion plasma and its theoretical systemization

[3] Promotion of Collaborative Use and Collaborative Research

(1) Are the high-level research abilities at universities and other institutions being widely concentrated, and is collaborative research as a Center of Excellence advancing appropriately?

(2) Does the Project contribute to research development at universities, and contribute as an academic hub that can disseminate to other academic fields?

(3) Through cooperation with ITER project, BA activities, and others, are contributions to international cooperation being undertaken?

[4] Development of Human Resources

Through simulation research, are there contributions to the development of human resources who can be internationally active in supporting the long-term development of fusion research?

[5] Future Planning

Is the next research plan appropriate for future goals? In particular, does it view the mid-term and the long-term prospects?

Subsequently, at the second External Peer Review Committee meeting and the Specialist Meeting, which were held on November 28, 2015, there was a detailed explanation given that followed the standpoint of evaluation and the points of evaluation, and a question and answer session followed. Moreover, on January 20, 2016, the third External Peer Review Committee meeting and the Specialist Meeting were held. The evaluation process and its coordination that followed the points of evaluation and topics determined by the External Peer Review Committee, including further questions and answers with the National Institute for Fusion Science, were undertaken. As the result, we achieved agreement in principle regarding the fundamental conclusions of the results of external review. Subsequently, resulting from this, the final report was compiled through discussions held via electronic mail.

As results of this external review of the Numerical Simulation Reactor Research Project, regarding the review items above, the conclusion of “highly evaluated in general” can be stated. In particular, regarding the Plasma Simulator, we can extremely highly evaluate the point that our country’s third-ranked supercomputer has been introduced and is contributing widely to the

simulation research of the fusion plasma community. Further, the high-level research abilities of universities have been widely concentrated, and together with actively promoting collaboration research as a Center of Excellence and the contributions to the development of human resources who can actively participate internationally in the fusion field is highly evaluated. Moreover, regarding, too, the high-level simulation research aimed at the construction of the Numerical Test Reactor and the clarification of physical mechanisms of fusion plasma, excellent results at the global level are appearing in large numbers, and this is highly evaluated. And regarding results that may be disseminated to other fields, and active participation and contributions to ITER and BA activities, too, these are highly evaluated. In the future, we hope there will be further academic dissemination and still further promotion of international cooperation with ITER. Regarding the Numerical Simulation Reactor Research Project, the world's leading research system that develops and organizes calculation codes is highly evaluated. However, from evaluation of the setting of goals and the levels of achievement, and, moreover, from management that can give birth to synergistic results based upon still further linkages among research groups, still further efforts are requested. Yet, for the further development, too, of plasma and fusion research, we anticipate continued effort aiming toward the introduction of a supercomputer of still higher performance.

Finally, we have summarized proposals regarding the path forward from now for the Numerical Simulation Reactor Research Project.

(1) Together with expressing more clearly the final goals of the "Numerical Simulation Reactor Research Project," and together with joint cooperation among each of the research groups, strengthening the system for checking the degree of completion with regard to the goals of the research groups. At the same time, it is necessary to consider a management that will give birth synergistic results through linkages among research groups.

(2) While keeping in view the roadmap that will complete integration, the strengthening of the preparation and the system of the research plan that is already aware of the combinative integration of each development element must be promptly undertaken.

(3) Regarding the preparation of the Plasma Simulator and the related research environments, we anticipate inspecting the conditions of each group for advancing the overall plan, and we anticipate that the preparatory planning that corresponds to the step-by-step achievement goals that take account of the conditions.

In particular, regarding the supercomputer, which is indispensable for integration, we anticipate active promotion in the future of the introduction of a still more powerful

high-performance supercomputer for contribution to the further development of plasma and nuclear fusion research.

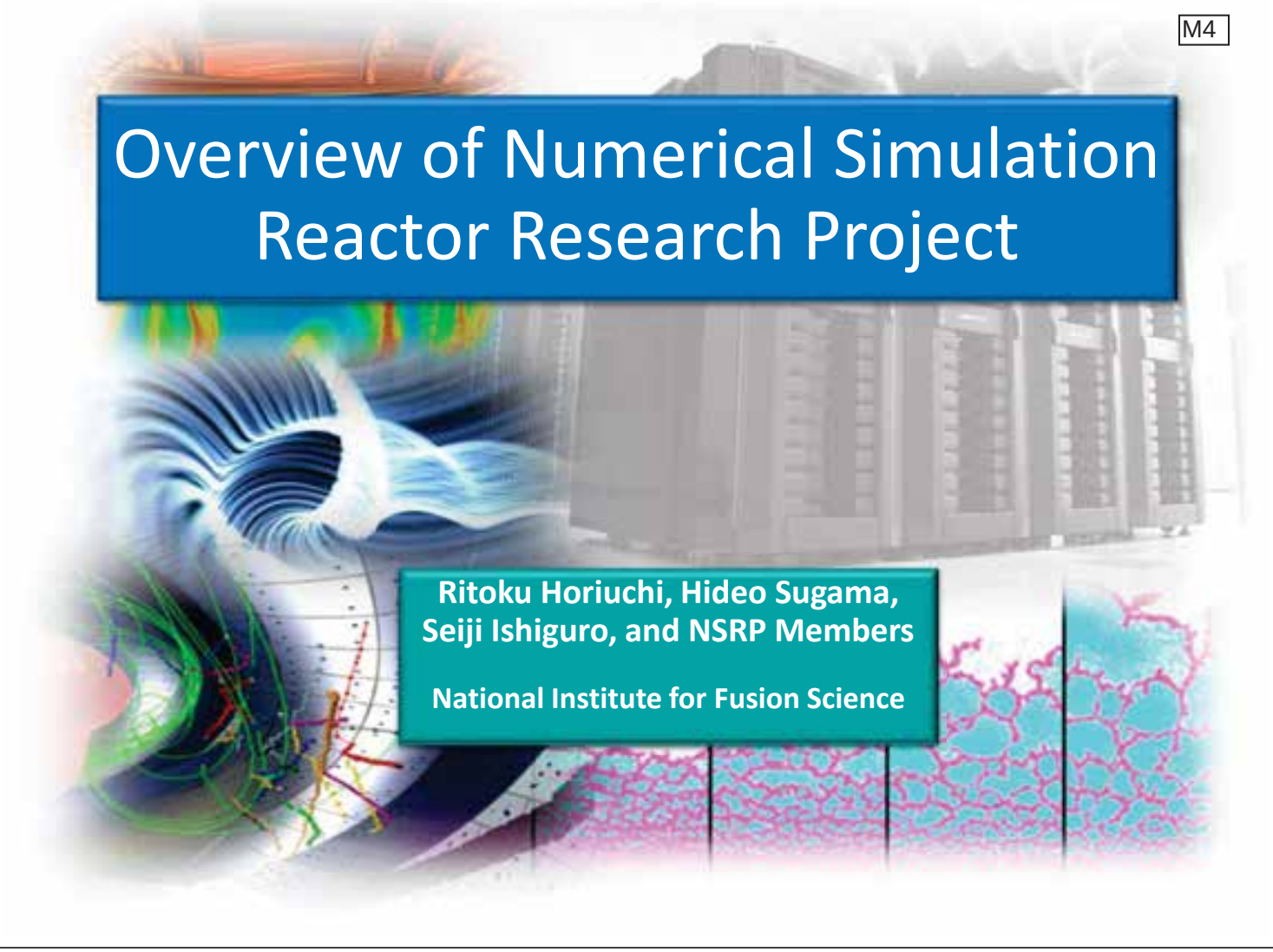
(4) As the warp and the woof for the project's promotion and academic development, supporting and developing research systems to which related researchers will contribute to both. In addition, we hope to advance the creation of new academic areas through multi-disciplinary activities that enhance competitive power that can extend to other fields.

(5) To maintain high standards that will continue into the future, and in order, too, to maintain important simulation research activities for the development of the fusion reactor, we anticipate effective planning for both quality and quantity in dealing organizationally in preparing human resources together with universities.

Documents

1. 2015 External Peer Review Presentation Materials

Overview of Numerical Simulation Reactor Research Project



Ritoku Horiuchi, Hideo Sugama, Seiji Ishiguro, and NSRP Members

National Institute for Fusion Science

Outline

1. Research system and environment
2. Research achievements
3. Promotion of cooperation and collaboration
4. Human resources development
5. Future plans

1. Development of research system and environment

(1) Does the research system function appropriately in accomplishing the objectives of the **Numerical Simulation Reactor Research Project** (NSRP)?

(2) Is the environment of the "Plasma Simulator" system and its related research developed appropriately? Is the "Plasma Simulator" effectively utilized for collaboration research?

Presentation by R. Horiuchi (1)

2. Research achievements

Does the NSRP produce high-level achievements in accordance with international standards for the following research areas by promoting theory and computer simulation research utilizing the Plasma Simulator?

(1) Construction of the **Numerical Test Reactor** for a helical fusion system

Presentation by H. Sugama

(2) Physics mechanisms of fusion plasmas and their theoretical systemization

Presentation by S. Ishiguro

3. Promotion of cooperation and collaborations

(1) Does the NSRP promote collaboration research as the center of excellence by integrating the high capabilities of universities and institutes?

(2) Does the NSRP contribute to the development of research in universities? Does the NSRP function as a research hub for the dissemination of academic information to other fields?

(3) Does the NSRP promote international cooperation through contributions to ITER, BA activities, and other international collaborations?

4. Human resources development

(1) Does the NSRP contribute to the development of human resources for the international scientific workforce required for long-term fusion science through simulation research?

5. Future plans

(1) Is the NSRP research plan for progressing toward the realization of the objectives appropriate? Is the research plan suitable for the next decade?

Presentation by R. Horiuchi (2)

1. Development of research system and environment
   (1) Does the research system function appropriately in accomplishing the objectives of the **Numerical Simulation Reactor Research Project**?
   (2) Is the environment of the "Plasma Simulator" system and its related research developed appropriately? Is the "Plasma Simulator" effectively utilized for collaboration research?

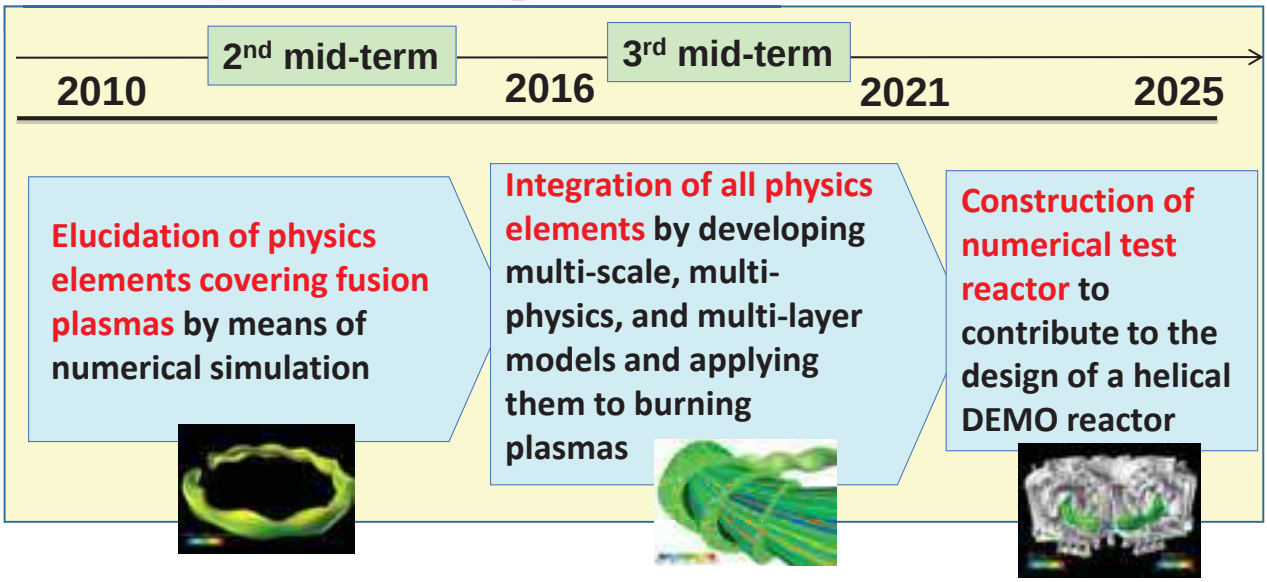
The research system of the NSRP is organized with capabilities and a flexibility that enables many collaborators from other projects and outside of NIFS to join the NSRP, and thus enhances collaboration and cooperative studies.

- The NSRP has produced numerous high-level achievements in accordance with international standards through many domestic and international collaborations. ➔ chapter 2
- Wide-ranging collaborations with the LHD Project have advanced extensively. ➔ in this chapter
- "Quantitative" and "Practical" collaborations have progressed with the Fusion Engineering Research Project (FERP). ➔ in this chapter

Three-step objectives of the NSRP:

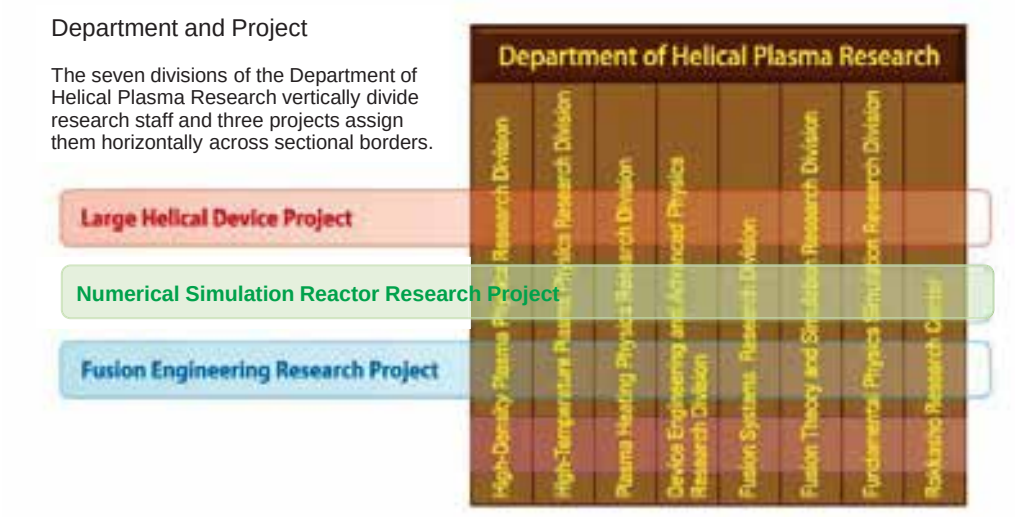
1. To clarify physics elements contributing to fusion plasma confinement
2. To integrate the mechanisms individually elucidated
3. To construct the Numerical Test Reactor (NTR)

Roadmap for realizing the NTR:



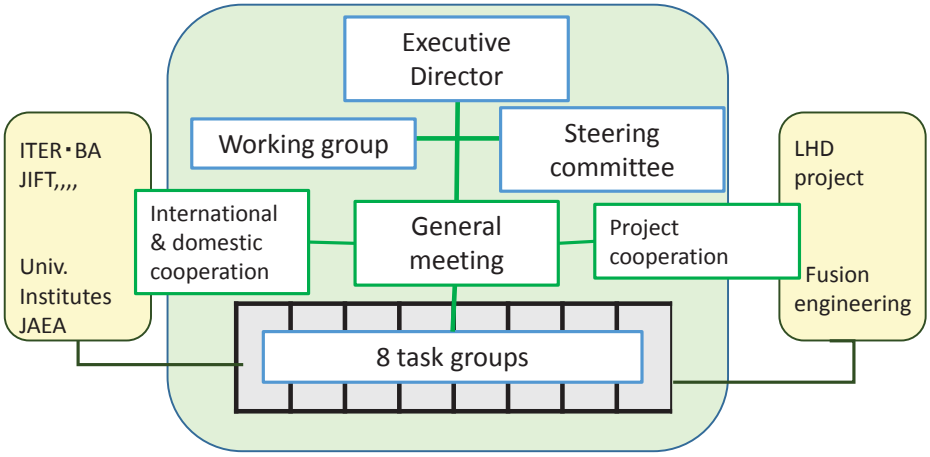
The NSRP performs its research activities in synergy with other projects under the framework of the NIFS research system

- [Research system] Research divisions are the warp of the research while the projects are the weft. Both are woven together to achieve the goal.



The NSRP research system is organized to make the project function well as a whole

- **Eight task groups** perform each task covering a wide range of fusion simulation subjects and are organized with capability and flexibility.
- The **Steering Committee** reviews NSRP activities and coordinates them so as to make the project function effectively as a whole.
- The **NSRP general meeting** plays a role in the fast and smooth communication of research information among the task groups, the projects, and international and domestic collaborators.



The eight task groups are organized to cover a wide range of fusion simulation subjects

group	leader	member
Plasma fluid equilibrium stability	K. Ichiguchi	14（sim. 9, exp. 3, collab. 2）
Energetic-particle physics	Y. Todo	5（sim. 2, exp. 2, collab. 1）
Integrated transport simulation	M. Yokoyama	21（sim. 4, exp. 13, collab. 4）
Neoclassical and turbulent transport simulaton	R. Kanno	14（sim. 9, exp. 1, collab. 4）
Peripheral plasma transport	Y. Suzuki	9（sim. 4, exp. 5）
Plasma-wall interaction	H. Nakamura	18（sim. 4, exp. 3, collab. 11）
Multi-hierarchy physics	H. Miura	18（sim. 12, collab. 6）
Simulation science basis	H. Ohtani	16（sim. 12, exp. 1, collab. 3）

Sim.: simulation staff, exp.:experiment staff, collab.:domestic collaborators

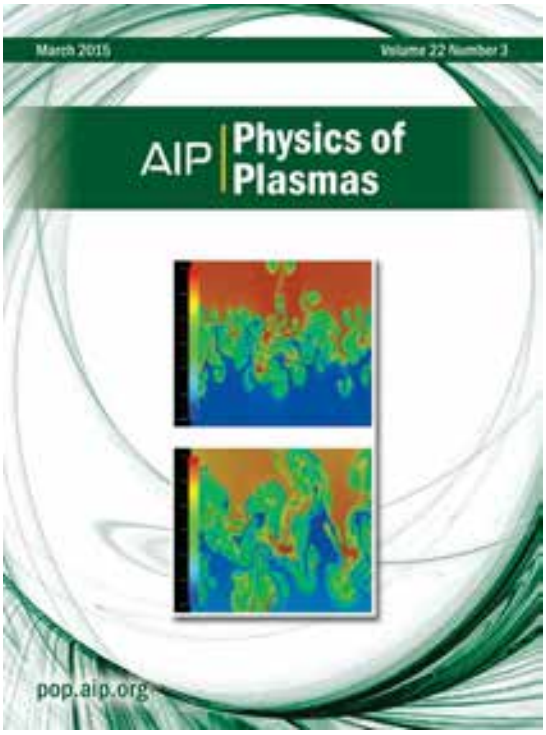
- Many collaborators from other projects and from outside NIFS have joined these task groups to enhance collaboration and cooperation studies.
- Most of the simulation staff in the NSRP also participate in other task groups.

The Steering Committee, the computer system Working Group, and the NSRP general meeting manage all NSRP activities

skip

- The Steering Committee (SC)
  - consists of the executive director, two division directors, and task group leaders
  - The meeting is periodically held to manage the NSRP activities to function appropriately as a whole.
- The computer system Working Group (WG)
  - consists of a Leader and five members.
  - manages and operates the Plasma Simulator and the LHD Numerical Analysis Server in collaboration with Fujitsu system engineers.
- The NSRP general meeting
  - is held once a month, and is chaired by group leaders in rotation.
  - enhances fast and smooth communication of research activities and important information relating to the NSRP.
- Project cooperation
  - Persons in charge enhance collaboration studies with other projects.

The NSRP has produced many high-level achievements in accordance with international standards through many domestic and international collaborations

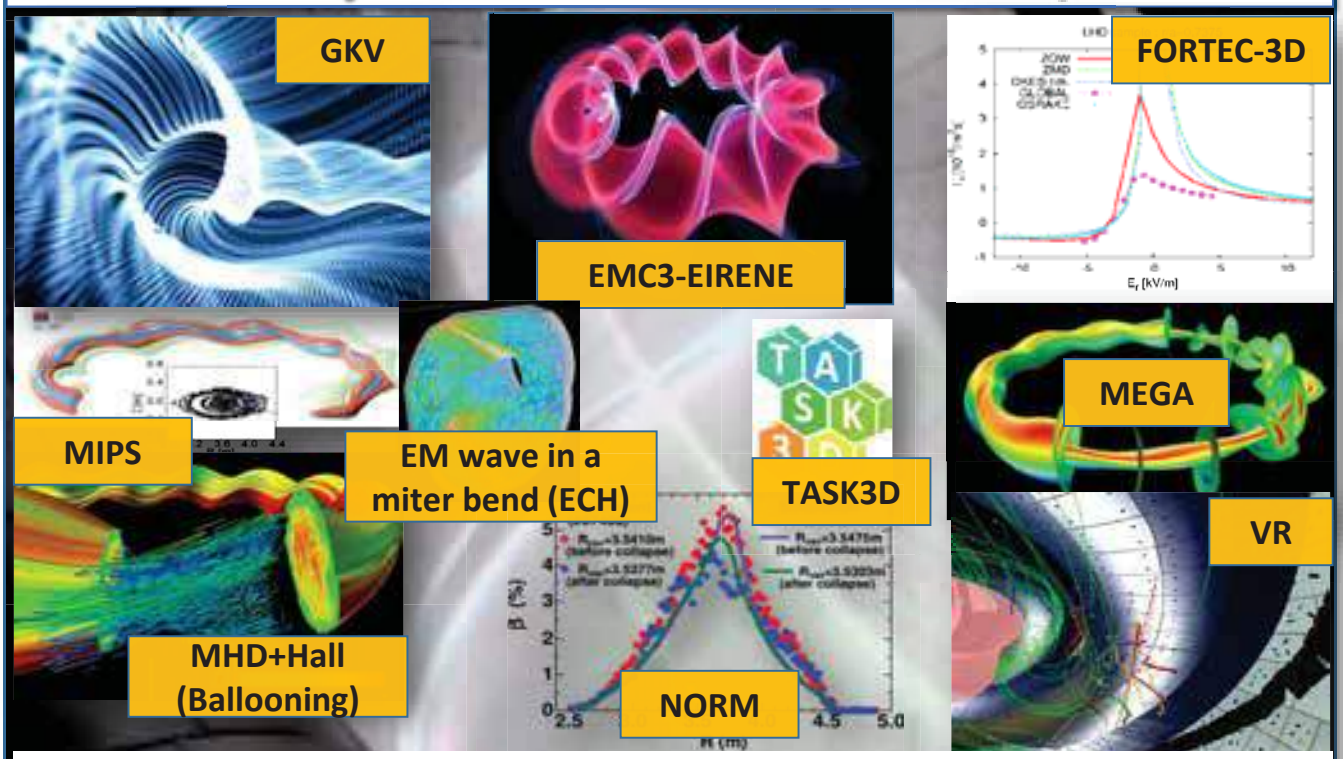


High-level achievement papers in 2010-2015

Item	Number of papers
Highly ranked journal papers (PRL, Nature Physics)	5
Invited papers at important international conferences (except IAEA-FEC)	40
IAEA-FEC presentations (oral talks)	73 (21)
Awarded papers and presentations	23
Total	141

These two figures from the article by R. Goto et al. gave glory to the cover of the March 2015 issue of *Physics of Plasmas*.

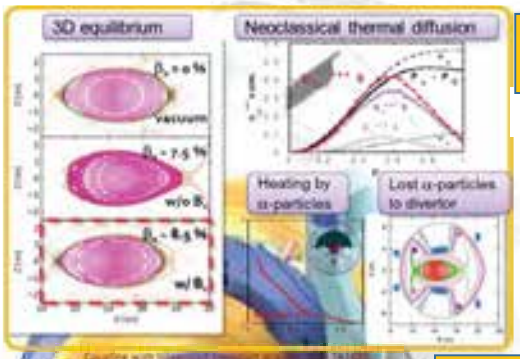
Wide-ranging collaborations with the LHD Project have advanced extensively



- Extensive **simulation code developments** and its **verification and validation (V & V)** have been conducted in order to enhance physics understanding.
- TASK3D and its close linkage to the LHD Data Server **received an award in 2015** (The Japan Society of Plasma Science and Nuclear Fusion Research).

"Quantitative" and "Practical" collaborations have advanced with Fusion Engineering Research Project (FERP)

Quantitative assessment of (1) core plasma and (2) feasibility study of start-up scenario

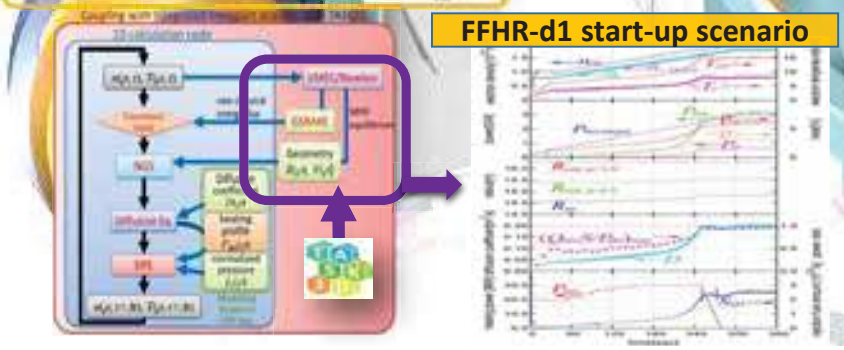


Core plasma assessment by cutting-edge simulation codes

J. Miyazawa et al., FTP/P7-34, 24th IAEA-FEC (2012)

Practical assistance to module setup/removal in reactor environment through **VR**

FFHR-d1 start-up scenario



T. Goto et al., FIP/P7-16, 25th IAEA-FEC (2014), NF 55 (2015) 063040, invited talk at ISHW2015

Quantitative assessment of core plasma and time evolution (start-up) analyses and **practical assistance through VR techniques** have advanced.

1. Development of research system and environment
   (1) Does the research system function appropriately in accomplishing the objectives of the **Numerical Simulation Reactor Research Project** (NSRP)?
   (2) Is the environment of the "Plasma Simulator" system and its related research developed appropriately? Is the "Plasma Simulator" effectively utilized for collaboration research?

(1) The environment of the "Plasma Simulator" system and its related research has been developed and been periodically upgraded for many collaboration research projects in the NSRP.
(2) The computer system Working Group manages and operates the Plasma Simulator and LHD Numerical Analysis Server in collaboration with Hitachi system engineers (till the end of March 2015) and Fujitsu system engineers (since June 1, 2015) to make the research environment function appropriately.
(3) More than 50 projects each year are performed as Plasma Simulator Collaboration Research

The "Plasma Simulator" system has been developed and periodically upgraded for the NSRP

- Phase 1 (March 2009 – August 2012): HITACHI SR16000 model L2, with 128 nodes
- Phase 2 (October 2012 – March 2015): HITACHI SR16000 model M1, with 322 nodes
- June 2015 – May 2019: FUJITSU PRIMEHPC FX100 with 2592 nodes

	Peak Performance	Memory	Storage
HITACHI SR16000 model L2 (Phase 1)	77 TFlops	16 TB	0.5 PB
HITACHI SR16000 model M2 (Phase 2)	315 TFlops	40 TB	2.0 PB
FUJITSU FX-100	2.62 PFlops	81 TB	10.0 PB

- Plasma Simulator (HITACHI SR16000) was ranked 65th in the world (7th in Japan) on the "TOP 500 LIST" in June 2009, and 95th in the world (8th in Japan) in the "TOP 500 LIST" in November 2012.
- Plasma Simulator (FUJITSU PRIMEHPC FX100) was ranked 27th in the world (3rd in Japan) in the "TOP 500 LIST" and 12th in the world (2nd in Japan) on the "High Performance Conjugate Gradients (HPCG)" in June 2015.

More than 50 projects every year were performed as Plasma Simulator Collaboration Research

FY	Collab. Research Projects	Users (NIFS/Univ.)	Simulation Jobs
2010	52	155 (48/107)	10,828
2011	58	195 (49/146)	10,815
2012	56	165 (51/114)	16,684
2013	53	158 (59/ 99)	19,548
2014	59	168 (62/154)	21,540
2015	58	154 (57/ 97)	16,209 (June – Aug.)

- There are 160 users each year with 60 from NIFS and 100 from universities.
- More than 15,000 jobs are run on Plasma Simulator each year.
- The average operating rate is 90%.

The computer system Working Group manages and operates Plasma Simulator and LHD Numerical Analysis Server in collaboration with FUJITSU system engineers

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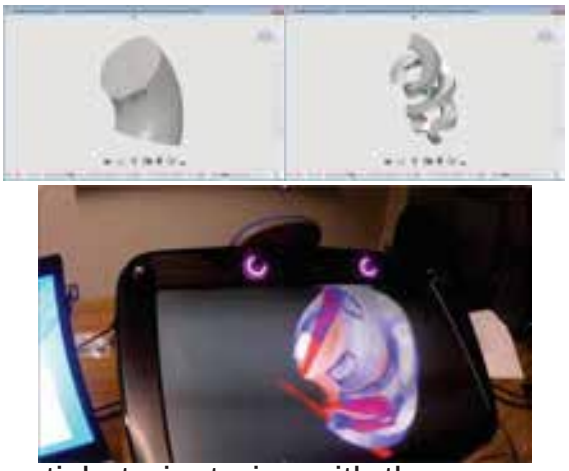
- Tasks
  - user registration, computer resources allocation, operation scheduling
  - management of hardware and software troubles
  - web site (figure): user manual, Q&A, text of user course, etc.
- Operation meeting is held every month to grasp and resolve issues.

Research assistance system has been developed for collaboration studies in the NSRP

- **User course** is held at the beginning of each fiscal year regarding
  - how to use the Plasma Simulator and the LHD Numerical Analysis Server
  - program tuning
  - OpenMP and MPI
  - AVS/Express, IDL (visualization/data processing software)
- Three system engineers from Fujitsu corporation are permanently working in the **Program Development Support Office** in NIFS
  - one engineer for operation support
  - two engineers for users' program development support
- In response to users' requests and questions, program development support engineers assist users.
  - porting programs from previous SR16000 to FX100
  - optimizing programs on FX100
  - parallelizing programs with SMP (auto parallelization), OpenMP and MPI
- **158 cases,** including 28 cases from universities, have been assisted for **program development support** since March 2009.

Virtual Reality (VR) system "CompleXcope" was upgraded and new desktop-type VR system was set up

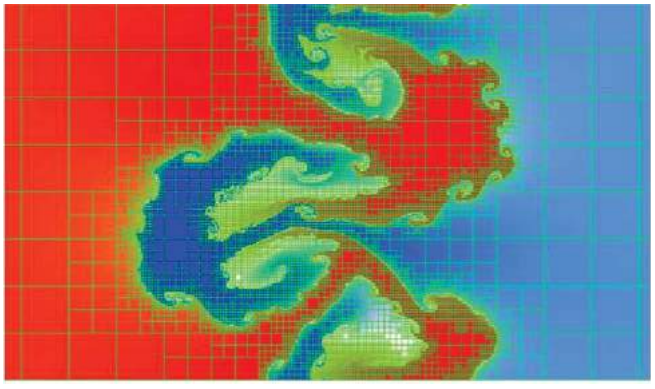
- Since the Plasma Simulator was upgraded, the size of simulation data increased explosively. A high-spec computer system was installed for analysis of large-scale simulation data in VR space.
- In order to contribute to the reactor design, we construct a system which displays CAD data by the desktop-type VR system.

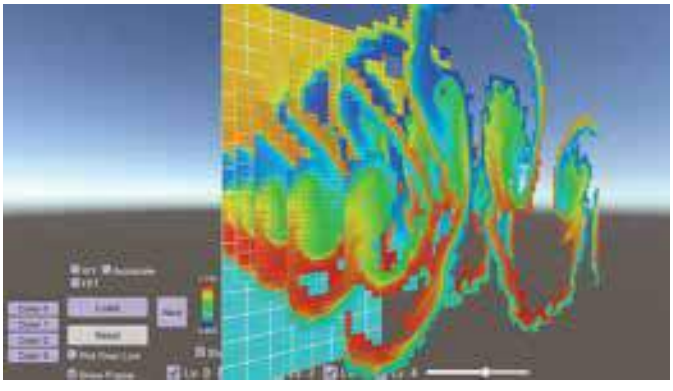


- It has become possible to analyze dust particle trajectories with the integrated visualization in the VR world.
- It has become possible to watch and move the FFHR parts three-dimensionally, and to perform collision detection when assembling.

Numerical framework of the AMR technique PAVANE and its visualization package have been developed

- Numerical framework based on adaptive mesh refinement (AMR) technique PAVANE has been developed.
- PAVANE is applied to Extended MHD simulation for Rayleigh-Taylor instability.
- Visualization package for PAVANE has also been developed.





- Adaptive refinement meshes enable us to perform simulations with high-resolution, saving computational resources.
- Complicated mesh systems can be visualized by using the new package.

The in-situ visualization library VISMO was developed to store image data instead of raw data

- As the sizes of simulation and its output data become larger and large, it becomes difficult to visualize the data as a post process.
- The in-situ visualization library VISMO was developed to couple the simulation code with the visualization code, and to perform the visualization process together with simulation on the same supercomputer.
- This research is based on the collaboration framework between NIFS and Hyogo University.

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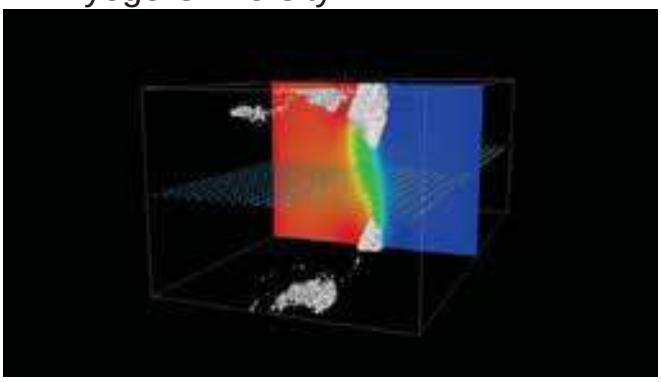

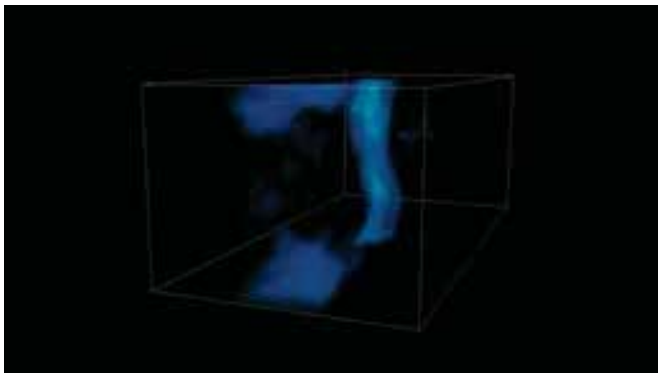

- We coupled the VISMO with the PIC simulation code PASMO and tested the coupled code on the Plasma Simulator, and confirmed that it works.

The Quantum Random Number Generator (QRNG) is developed in collaboration with ICFO

- For very-large-scale Monte Carlo simulations, efficient methods to generate high-quality random numbers are required.
- In the collaboration with ICFO (Spain), we tested the application of QRNG, which generates random numbers according to the randomness of the phase of laser pulses. QRNG is expected to be more than 10 times faster than the other physical RNGs available today.

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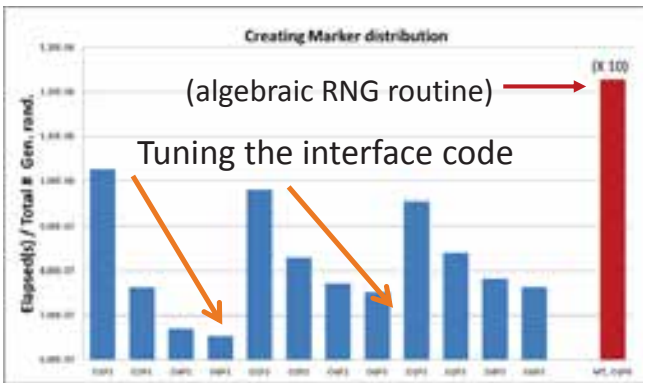
Fast



(parallel thread and cache size tuning)

- Though it is still a prototype, by tuning the interface code to convert the laser pulse signal to random numbers, the speed of QRNG in a realistic Fortran simulation becomes ~1/10 of an algebraic pseudo RNG subroutine. Further improvement of the device is ongoing in ICFO.

Data compression concept "TOKI" succeeded in reducing data size within a given numerical error

- The purpose of this program is to propose a new methodology of effective data compression which reduces dramatically data size within a given numerical error.
- It is expected that this method will reduce the size of simulation data and the size of the viewer software memory. As a result, the viewer software will be able to read data faster and visualize very large-scale simulations.
- This study is based on the collaboration framework between NIFS, NAOJ, TITECH, and NDA （NIFS: 2 persons, Others: 4 persons).

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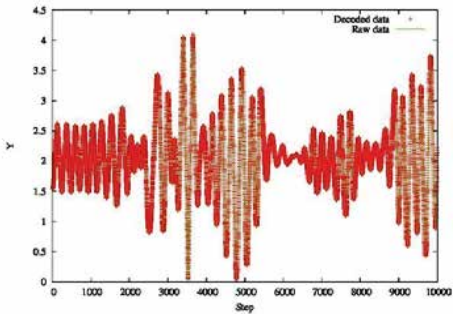

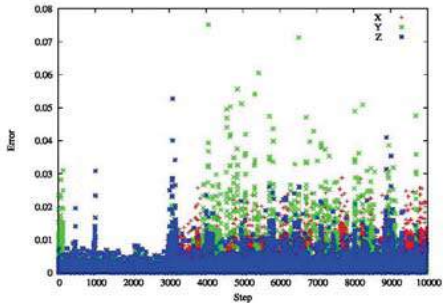

- The concepts of data compression were decided based upon a plan, and the prototype of a data-compress encoder was constructed. This prototype was applied to plasma and N-body/gas simulations, and the validity was confirmed.

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Presentation by R. Horiuchi (1)

2. Research achievements
   Does the NSRP produce high-level achievements in accordance with international standards for the following research areas by promoting theory and computer simulation research utilizing the Plasma Simulator?
   (1) Construction of the **Numerical Test Reactor** for a helical fusion system

Presentation by H. Sugama

   (2) Physics mechanisms of fusion plasmas and their theoretical systemization

Presentation by S. Ishiguro

2. Research achievements

Does the NSRP produce high-level achievements in accordance with international standards for the following research areas by promoting theory and computer simulation research utilizing the Plasma Simulator?

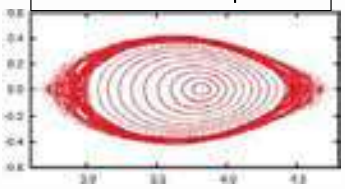
(1) Construction of the **Numerical Test Reactor** for a helical fusion system

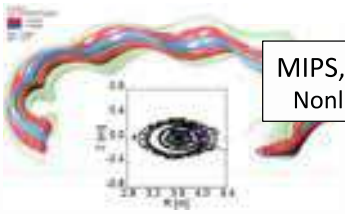
The NSRP produces a large number of high-level achievements in theory and simulation research for construction of the Numerical Test Reactor.

- Development of various simulation codes, which constitute the Numerical Test Reactor, and their validations by comparisons with experiments have progressed.
- These simulation codes contribute to numerous analyses of fusion plasmas in LHD and other devices as well as to predictions of FFHR plasma performance.

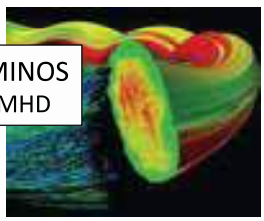
Extensive simulation code developments and comparisons between simulation and experiments have been performed

HINT MHD equilibria

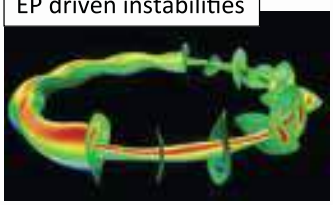




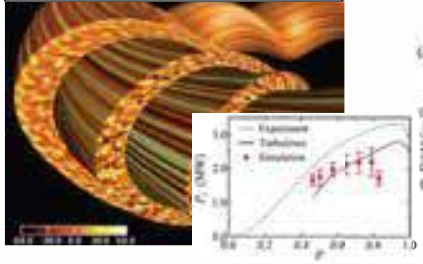
MIPS, MINOS
Nonlinear MHD



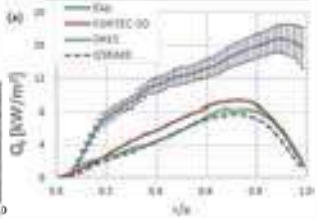
MEGA
EP driven instabilities



GKV Turbulent transport

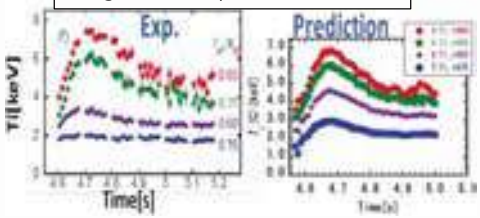


FORTEC-3D, KEATS
Neoclassical transport



EMC3-EIRENE (Max-Planck IPP)
Edge plasma

TASK3D (Kyoto Univ)
Integrated transport code



Virtual Reality

Contributions to the Numerical Test Reactor for a helical fusion system

- For identification of key physics determining stability boundary in heliotrons, effects of RMP, viscosity, heat conductivity, and diamagnetic rotation on the global stability in LHD and FFHR are clarified by MHD simulations.
- V&V studies and extensions of kinetic simulation codes are carried out for evaluating NC & GK turbulent transport in LHD and other devices.
- Hybrid simulation code, MEGA, has been successfully applied to investigate energetic-particle driven instabilities and resultant transport of energetic particles in LHD, DIII-D, and ITER.
- Simulation codes to investigate peripheral plasma transport and plasma-wall interactions are developed and validated by comparisons with experimental results.
- Extensions and applications of integrated simulation suites, TASK3D-a (analysis) and TASK3D-p (prediction), have been further advanced. They have contributed to physics interpretations of LHD plasmas and the quantitative assessment of FFHR-d1 design.

Contributions to the Numerical Test Reactor for a helical fusion system

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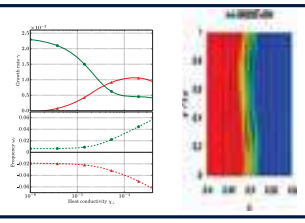
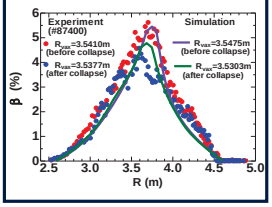
Outline of research achievements and future aim in MHD fluid simulation studies

Diamagnetic effects :
linear analysis (ideal modes)
nonlinear analysis (resistive modes)

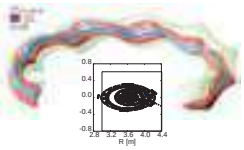


Multi-scale RMHD simulation for LHD swing operation (NORM)



upgrade

3D full MHD simulation including RMP (HINT+MIPS)



knowledge

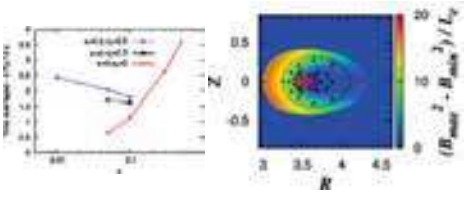
upgrade

knowledge

future aim

3D Simulation including key physics to identify stability boundary and application to numerical test reactor

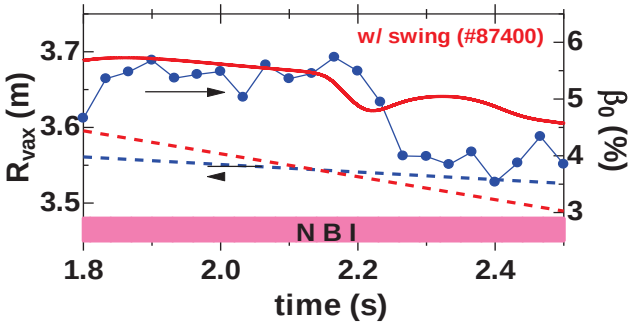
Turbulence viscosity and pellet ablation analyses

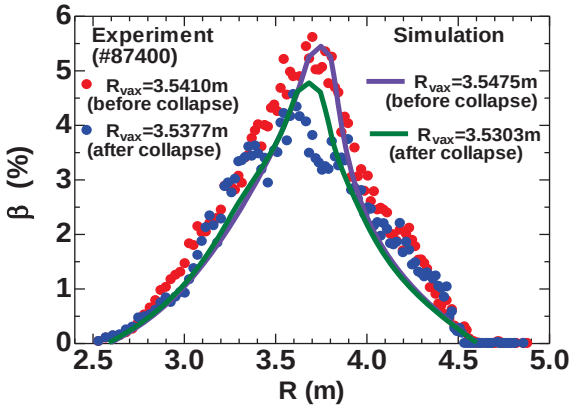


Multi-scale simulation reproduces a partial collapse observed in the magnetic axis swing operation in LHD

[K. Ichiguchi, et al., 24th IAEA FEC 2012 (poster), Nucl. Fusion 2015]

- The multi-scale numerical scheme based on the NORM dynamics code and the VMEC equilibrium code is advanced for the analysis.
- The rotational transform change due to the dynamics is newly incorporated in the equilibrium calculation.



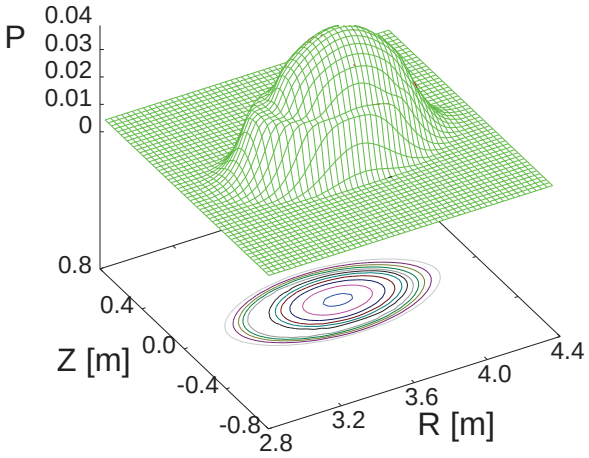


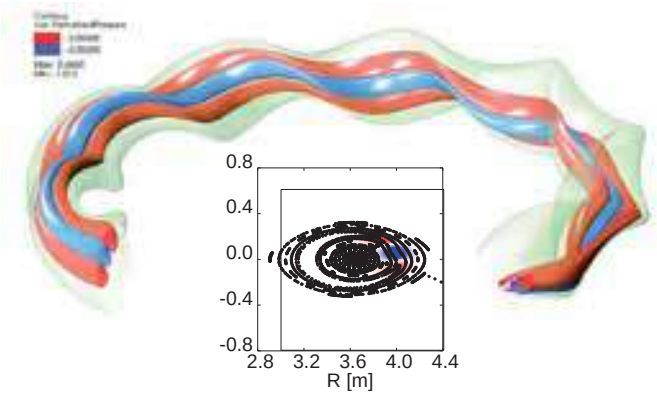
- The experimental results are reproduced showing that a partial collapse occurs repeatedly in the case with the axis swing while the plasma is stable in the case without the axis swing.
- The inward axis shift due to the collapse agrees with the experiments.

RMP changes the pressure driven mode in LHD

[K. Ichiguchi, et al., 25th IAEA FEC 2014 (oral), Nucl. Fusion 2015]

- 3D LHD equilibrium consistent with horizontally uniform RMP is calculated with the HINT2 code, which shows a magnetic island.
- The 3D dynamics in the equilibrium is studied with the MIPS code.

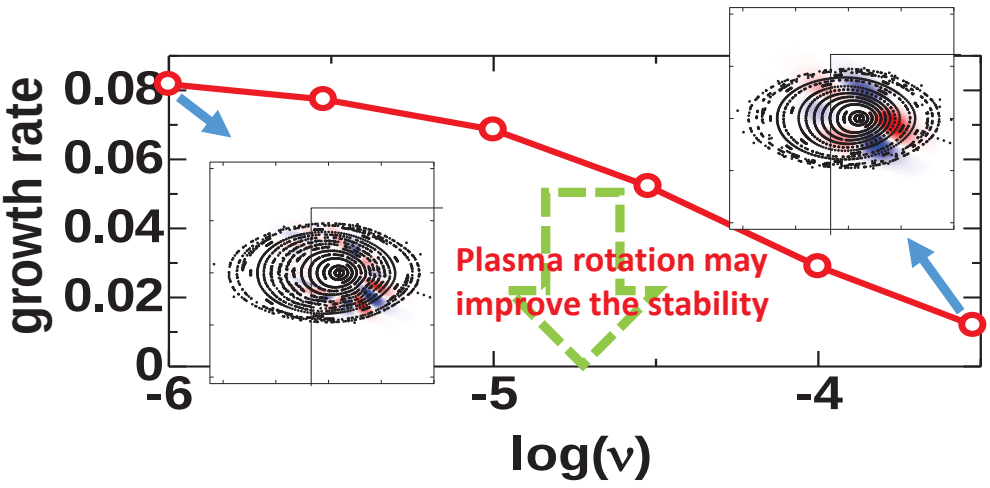




- The mode structure changes from interchange type to ballooning-like type because of the locally flat pressure profile inside the island.
- The phase of the pressure collapse in the toroidal direction is fixed by the RMP. Similar fixed phase is observed in the LHD experiments.

MHD Stability of FFHR is analyzed with 3D equilibrium and stability codes

- Linear MHD stability of FFHR-d1(FIS-JA-MPD) is analyzed with the HINT equilibrium and the MIPS dynamics codes.
- Viscosity dependence of the growth rate is studied.

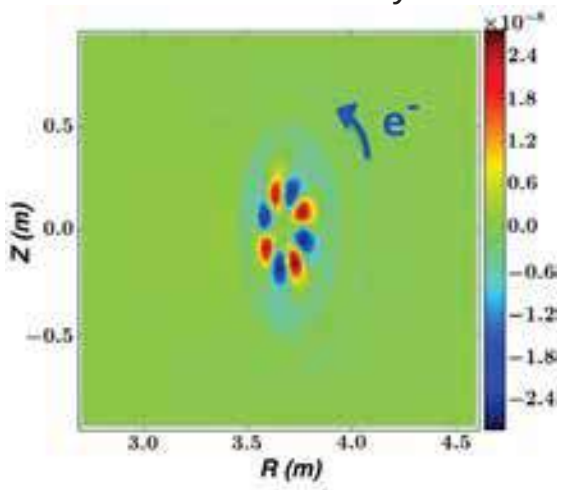


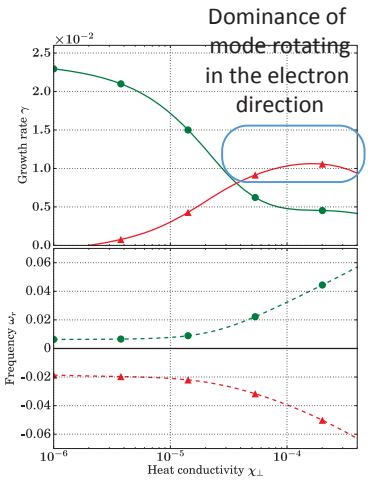
- Pressure driven mode is unstable for the viscosity estimated from fluid turbulence analysis in a slab geometry (10^{-5}).
- Since stability improvement due to ExB and diamagnetic rotations can be expected, more precise analysis including the contributions is progressing.

Linear branch of electron diamagnetic rotation of ideal interchange mode is obtained

[T. Nicolas, et al., Plasma Fus. Res. 2015, submitted to Nuclear Fusion 2015]

- Diamagnetic rotation of interchange modes is studied with both 3D MIPS simulations and eigenvalue analyses based on 3-field reduced MHD model.
- Effects of heat conductivity and viscosity on the mode rotation are studied.





- Some MIPS results with viscosity and heat conductivity show rotation in the electron diamagnetic direction that is observed in LHD experiments.
- 3-Field analysis shows that sufficient large heat conductivity and viscosity make the branch with the electron diamagnetic rotation dominant.

Rotation velocity of resistive interchange modes in LHD experiments is reproduced by simulation

[M. Sato, et al., 11th APPTC 2014 (oral)]

- In LHD experiments, it is observed that interchange modes rotate with the electron fluid velocity (electron diamagnetic velocity + ExB flow velocity).
- In this study, the propagation velocity of interchange modes is investigated by nonlinear simulation based on four-field model in slab plasmas.

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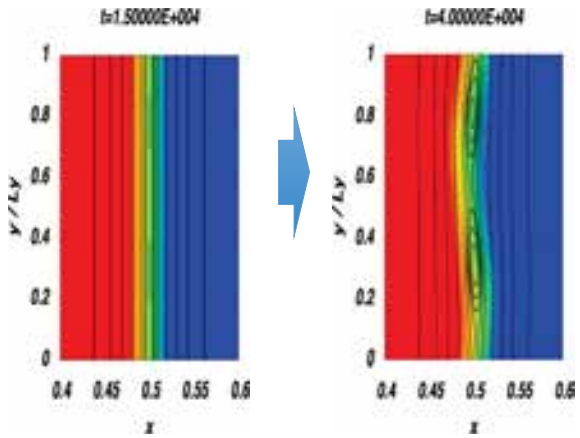
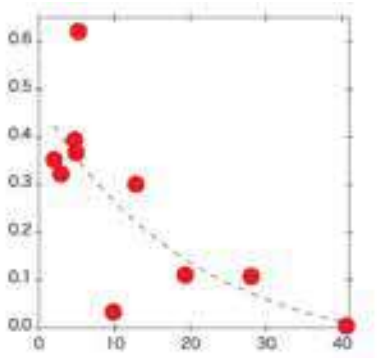


$$\left| \frac{v_w - v_e}{v_{De}} \right|$$



Island width / ion Lamor radius

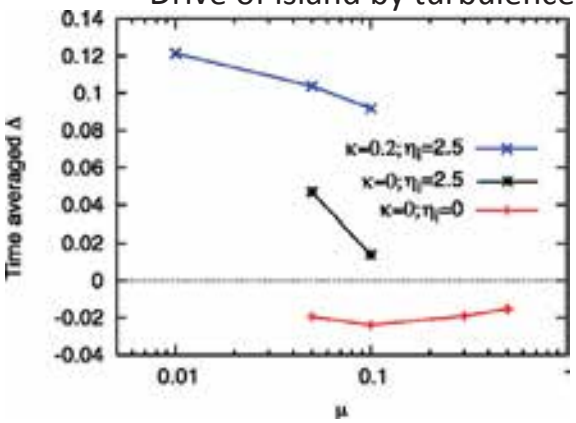
- In the linear phase, the propagation velocity of modes is about 60% of the electron fluid velocity. In the nonlinear phase, however, magnetic islands are formed and the propagation velocity becomes close to the electron fluid velocity as the saturated island width increases.

Magnetic islands driven by ITG turbulence are discovered

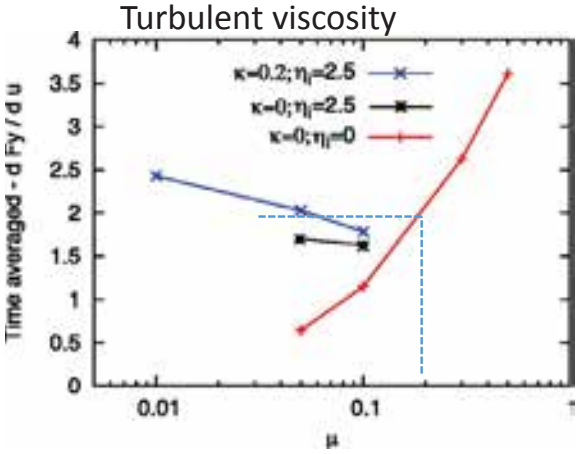
A. Ishizawa and F.L. Waelbroeck, Phys. Plasmas (2012), Phys. Plasmas (2013)

- Magnetic island evolution in finite ion temperature plasma is firstly studied.
- Drive of magnetic island by ITG turbulence is firstly evaluated.
- Turbulent viscosity is evaluated.

Drive of island by turbulence



Turbulent viscosity

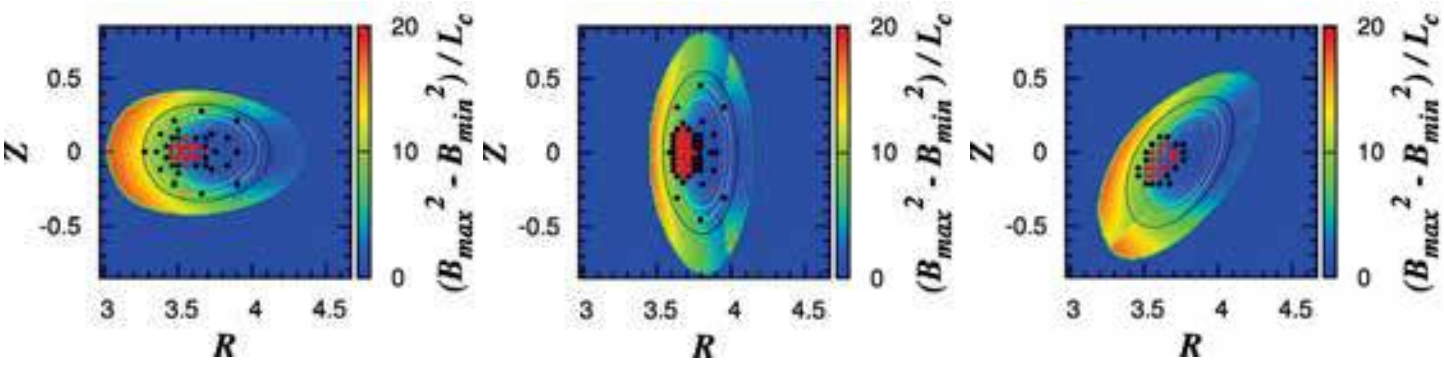


- Magnetic island can be destabilized when Ti is finite and W> $5\rho_{*i}$.
- Turbulence drives magnetic island growth.

Favorable pellet ablation points are found from which the plasmoids drift toward the inner magnetic surface

[R. Ishizaki, et al., Plasma Fus. Res. 2014]

- To clarify motion of a plasmoid induced by pellet ablation in the LHD, MHD simulations have been conducted by using CAP code.
- The motions of plasmoids are investigated on several poloidal cross sections.



- The plasmoids indicated by red circles drift toward the inner magnetic surface.
- Density increase outside the ablation region in the LHD pellet injection is explained by the plasmoid behavior indicated by black circles.

Summary of research achievements in MHD fluid simulation studies

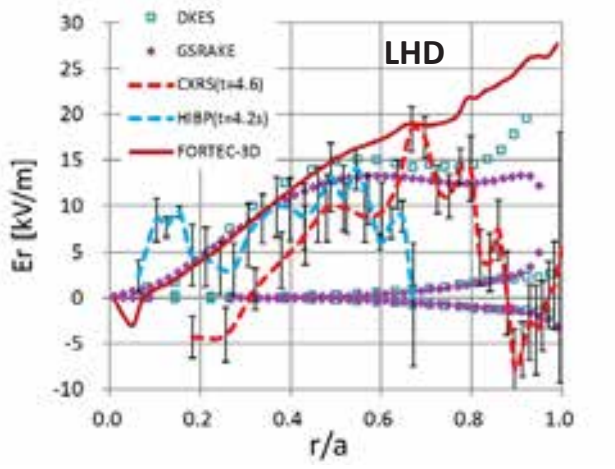
- Multi-scale MHD simulation reproduces a partial collapse observed in the magnetic axis swing operation in LHD.
- Effects of RMP on pressure driven modes are elucidated by HINT2 & MIPS simulations and fixed phase of the collapse observed in LHD is explained.
- MHD stability of FFHR against pressure driven modes is analyzed.
- Mechanism of mode rotation in the electron diamagnetic direction observed in LHD experiments is clarified for both ideal and resistive interchange modes.
- Magnetic islands driven by ITG turbulence are discovered and the viscosity due to the turbulence is evaluated.
- Favorable pellet ablation points in LHD are found by the CAP code simulation in which the plasmoids drift toward the inner magnetic surface.

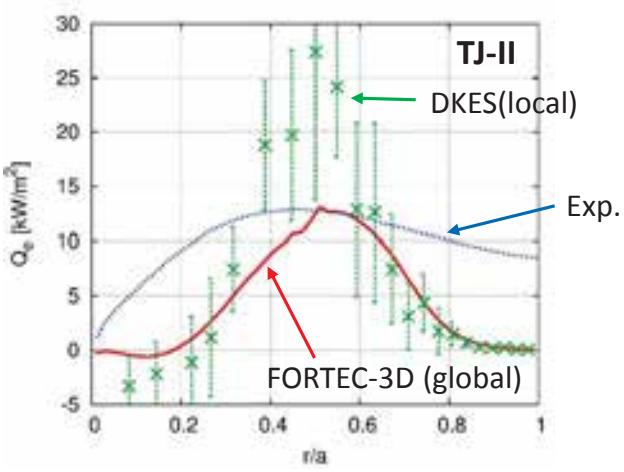
Contributions to the Numerical Test Reactor for a helical fusion system

- For identification of key physics determining stability boundary in heliotrons, effects of RMP, viscosity, heat conductivity, and diamagnetic rotation on the global stability in LHD and FFHR are clarified by MHD simulations.
- **V&V studies and extensions of kinetic simulation codes are carried out for evaluating NC & GK turbulent transport in LHD and other devices.**
- Hybrid simulation code, MEGA, has been successfully applied to investigate energetic-particle driven instabilities and resultant transport of energetic particles in LHD, DIII-D, and ITER.
- Simulation codes to investigate peripheral plasma transport and plasma-wall interactions are developed and validated by comparisons with experimental results.
- Extensions and applications of integrated simulation suites, TASK3D-a (analysis) and TASK3D-p (prediction), have been further advanced. They have contributed to physics interpretations of LHD plasmas and the quantitative assessment of FFHR-d1 design.

FORTEC-3D code calculates neoclassical particle/heat flux, bootstrap current, and neoclassical viscosity

- Solves drift-kinetic equation by Monte Carlo method. Applicable to general 3D toroidal plasmas (LHD, FFHR, W7-X, TJ-II, tokamak+RMP, …)
- Evaluate neoclassical flux, ambipolar- , and viscosity with high accuracy.





- Intense V&V study has been carried out among NC codes / helical devices. NC simulation can reproduce the observed electric field profile in LHD.
- Improvement of the drift-kinetic model (radially local+mono-energy approx. → full 5D) results in factor 2-3 difference in NC particle and heat flux.

Tangential magnetic drift term is the key factor of the "global effect" in neoclassical transport calculation

- Conventional neoclassical simulation (DKES, GSRAKE, etc.) adopts the local and mono-energy approximation, 3D reduced drift-kinetic equation.
- NC fluxes from 5D global code (FORTEC-3D) largely differ from the local codes. To explain this discrepancy, new 4D models have been developed.

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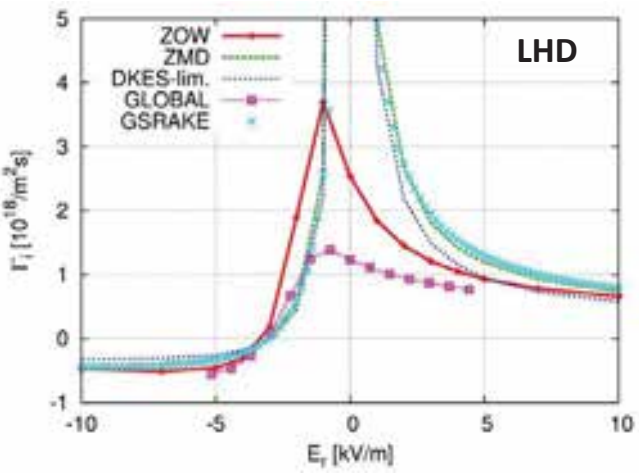
- Zero-Orbit-Width (ZOW) model: neglect only the radial magnetic drift
- Zero-Magnetic-Drift (ZMD) model: neglect both normal and tangential magnetic drift term to flux surface

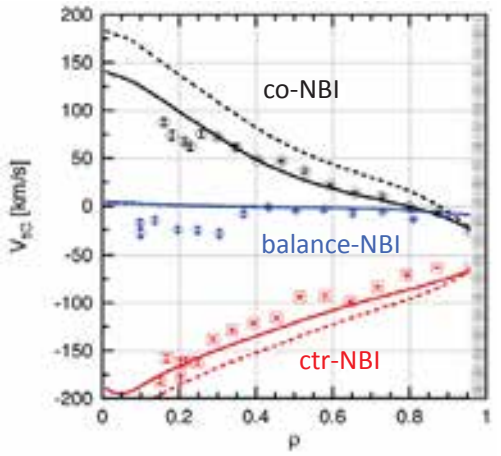
FORTEC-3D code can switch the DKE model among 5D global, 4D radially local (ZOW, ZMD), and 3D (DKES-limit).



- 3D and 4D ZMD models show peaky dependence of NC flux at
- By including tangential magnetic drift effect in 4D ZOW model, it reproduces the same dependence of as that from 5D global code.

Neoclassical toroidal viscosity (NTV) from error field affects the toroidal rotation in JT-60U

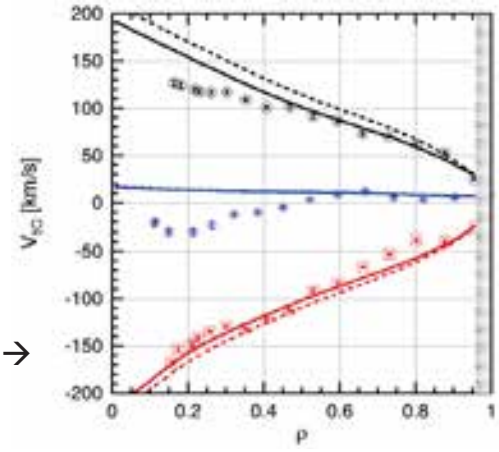
- Small toroidal magnetic ripples in JT-60U (by installing ferritic steel tiles between coils) was found to affect the toroidal rotation profile.
- NTV caused by asymmetry of the magnetic field is evaluated by FORTEC-3D code, and the result is used in the integrated transport code, TOPICS.



--------- : w/o NTV
——— : w/ NTV
○,◇,□ : observation

← Before installing FST

After installing FST →



- The toroidal rotation profile predicted with including the NTV effect reproduces well the observation, especially in the case before installing FSTs.
- Next target: JT-60SA (RMP) and ITER (error field by test blanket module)

Effect of RMPs on the radial thermal diffusivity is weakened by collisions, and is extremely small compared with the Rechester-Rosenbluth prediction

- The drift-kinetic simulation code KEATS is applied to ion heat transport in a toroidal plasma affected by RMPs under an assumption of zero electric field

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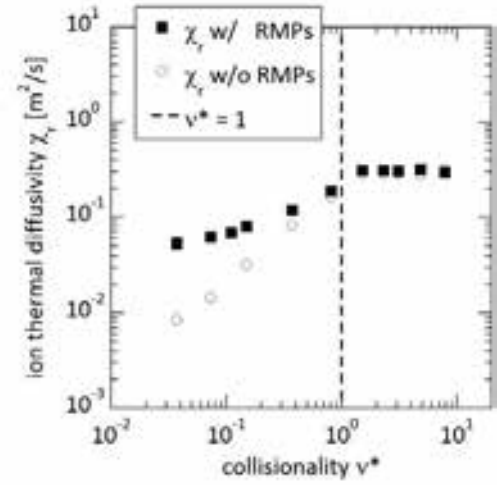
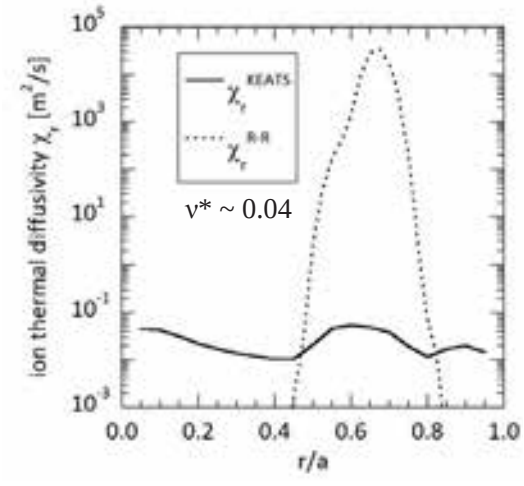


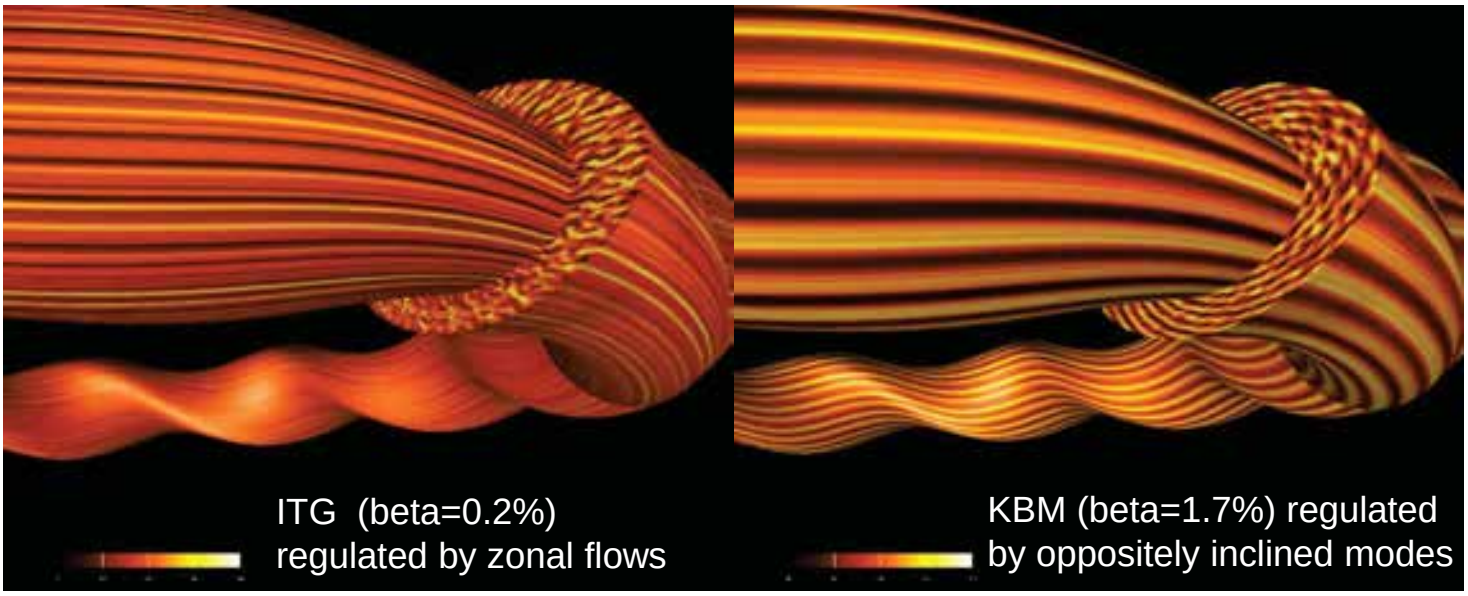


- The effect of RMPs on the thermal diffusivity is weakened by the Coulomb collision in case of higher collisionality. [R. Kanno *et al.*, Plasma Phys. Control. Fusion (2013)]
- The diffusivity evaluated by the simulation is extremely small compared with the Rechester-Rosenbluth prediction, as shown in recent experiments.

New saturation mechanism of turbulence with weak zonal flow is found

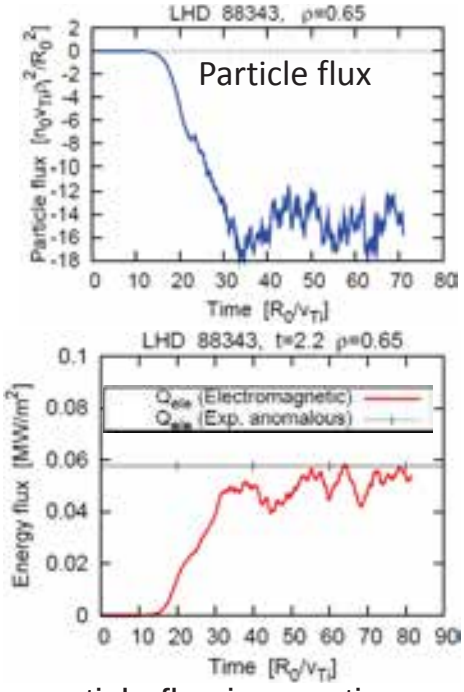
- Electromagnetic turbulence in LHD

A. Ishizawa, Nucl. Fusion (2013), Phys. Plasmas (2014), Journal of Plasma Physics (2015)
A. Ishizawa, APS-DPP invited talk (2013)

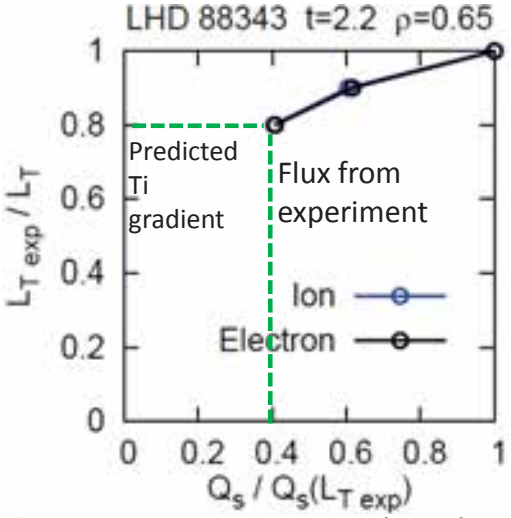


- Saturation of the KBM turbulence is caused by nonlinear interactions between inclined modes.

Turbulent transport in an LHD discharge is evaluated



Prediction of profile by flux matching



L_T : Temperature gradient length
$L_{T\exp}$: Experimental observation of LT
Q_s : Heat flux of "s" species
$Q_s(L_{T\exp})$: Experimental observation of Qs

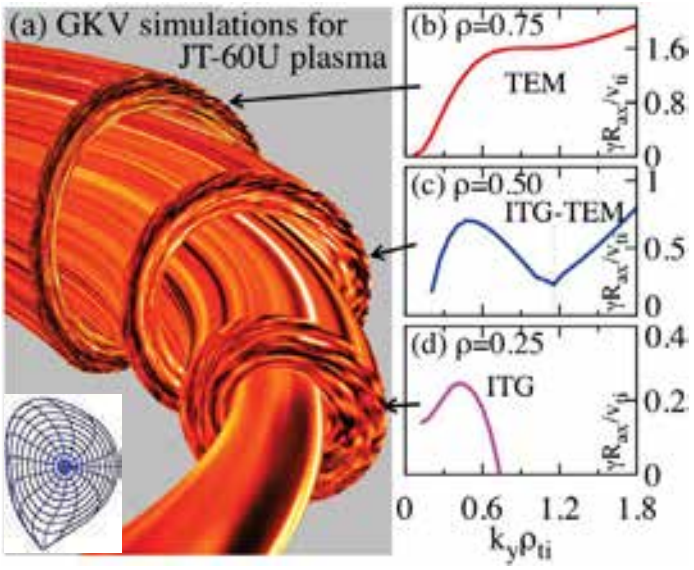
- The particle flux is negative.
- The electron energy flux is in good agreement with the experimental observation.
- The predicted temperature gradient length deviates from experimental observation about 20%.

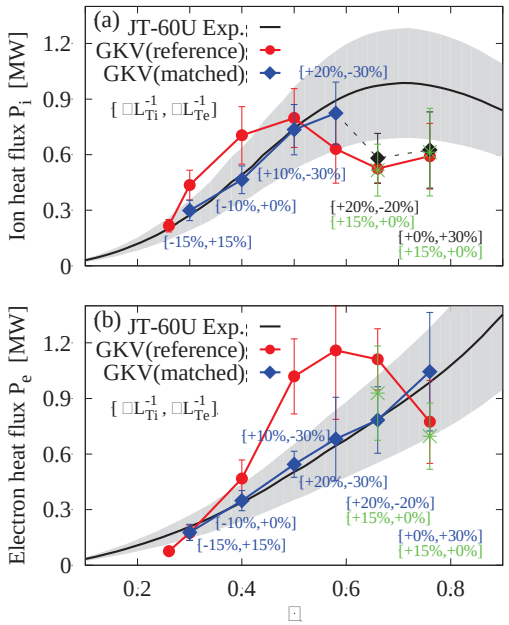
A. Ishizawa, Nucl. Fusion (2015)

Validations of ion and electron heat transport have been successfully performed in JT-60U tokamak

- GKV is extended to incorporate realistic tokamak equilibrium, and ITG-TEM turbulence simulations of JT-60U L-mode plasma are first performed.

Nakata et al., PFR2014, Nakata et al., IAEA-FEC2014, Nakata et al., APPTC2014 (invited)





- GKV simulations reproduce the comparable ion and electron heat transport levels within 30% profile variations against the experimental results.

GKV simulations have been extended for turbulence analyses with multiple ions and kinetic electrons

- For multi-species turbulence analyses, accurate collision operator preserving both conservation properties and H-theorem is implemented on GKV.

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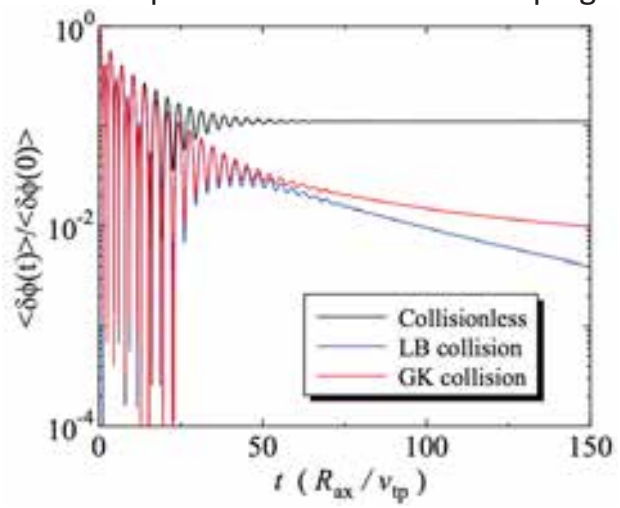
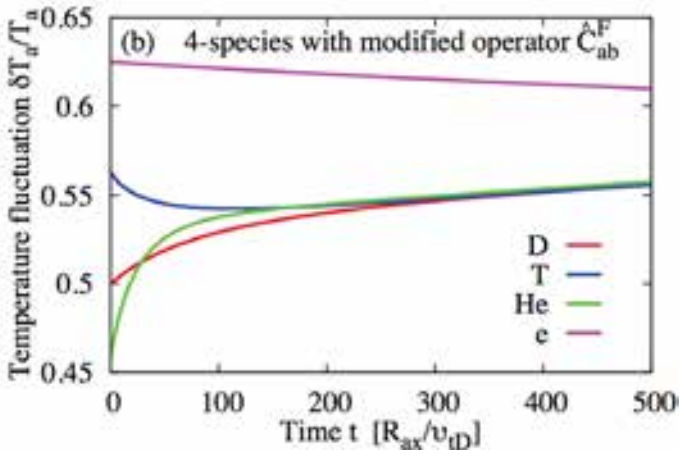
Nunami et al., PFR2015; Nakata et al., CPC2015; Nakata et al., PSS2015 (invited)

Comparison of zonal flow damping



Thermal relaxation in 4-species plasma



- Collisional processes in multi-species plasma, including zonal-flow damping, are accurately solved by newly extended simulation model.
- Multi-ion turbulence simulations can be applied to LHD Exp. and DEMO/FFHR.

Benchmarking of gyrokinetic simulation code under international collaboration

- Benchmarking of gyrokinetic simulations has been performed between GKV and GS2 codes under international collaboration with PPPL.
- Linear ITG instabilities in LHD plasma have been compared with each other.

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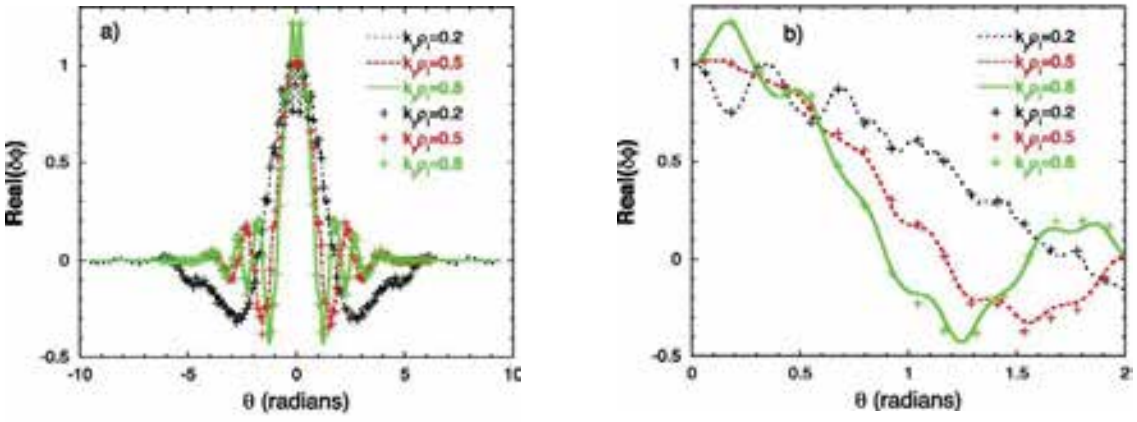
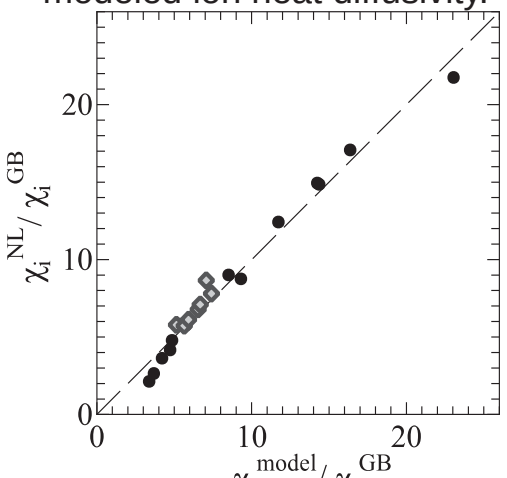


- Good agreements are confirmed between both results of the ITG growth rates and the frequencies.
- Eigen-functions by GKV also agree with GS2 results.

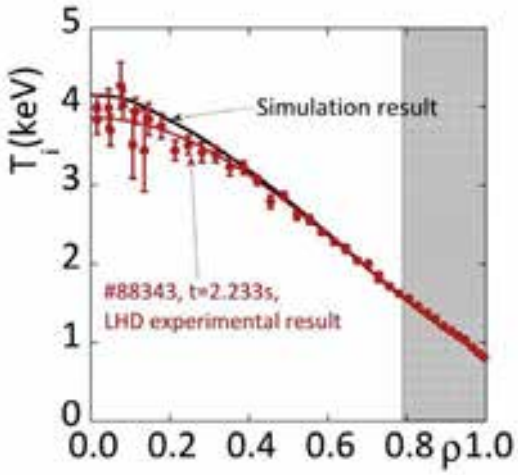
Transport simulation results using GKV-based diffusivity model are quantitatively compared with T_i profile observed in LHD

- How to apply the turbulent ion heat diffusivity derived from the gyrokinetic simulation for the transport simulation is shown.
- The dynamical transport simulation (TASK3D-p) is performed, using the modeled ion heat diffusivity.



$$\frac{\chi_i^{model}}{\chi_i^{GB}} = \frac{A_1(\int(\tilde{\gamma}_{\tilde{k}_y}/\tilde{k}_y^2)d\tilde{k}_y)^{\alpha}}{A_2 + \tilde{\tau}_{ZF}/(\int(\tilde{\gamma}_{\tilde{k}_y}/\tilde{k}_y^2)d\tilde{k}_y)^{1/2}}.$$

M. Nunami et al., PoP, Vol. 20 092307 (2013)



S. Toda et al., J. Phys.: Conf. Ser., Vol. 561 012020 (2014)

- The dynamical transport simulation results by use of the GKV-based transport model are quantitatively compared with the ion temperature profile in LHD#88343.

Summary of research achievements in neoclassical and turbulent transport simulations

- Intensive V&V studies among NC codes and helical devices improve reliability of simulations of NC particle/heat fluxes and radial electric field profile.
- The toroidal rotation profile in JT-60U with error field is well reproduced by the simulation evaluating the neoclassical toroidal viscosity.
- The GKV code for EM turbulence in helical systems is developed, and saturation of KBM turbulence in a finite beta LHD plasma is verified to be caused by nonlinear interactions between inclined modes.
- Turbulent particle and heat fluxes of ions and electrons in LHD and JT-60U are evaluated by GKV simulations and successfully compared with experimental results for the first time.
- The GKV code is extended for turbulence analyses with multiple ions and kinetic electrons. [The 10th Young Scientist Award of the Physical Society of Japan is presented for the GKV code studies.]
- The turbulent ion heat transport model derived from GKV simulations is installed into the integrated code, TASK3D, and validated by comparing the simulation results with the ion temperature profile observed in an LHD experiment.

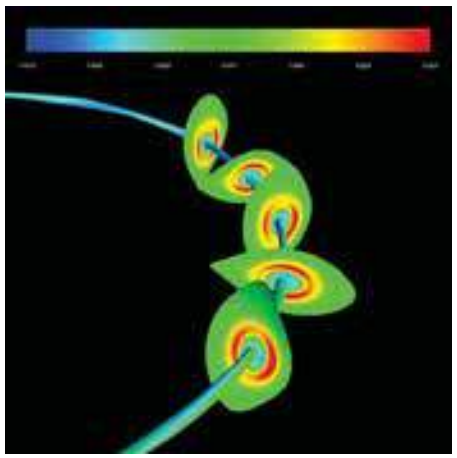
Contributions to the Numerical Test Reactor for a helical fusion system

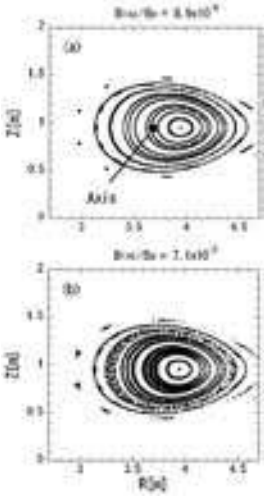
- For identification of key physics determining stability boundary in heliotrons, effects of RMP, viscosity, heat conductivity, and diamagnetic rotation on the global stability in LHD and FFHR are clarified by MHD simulations.
- V&V studies and extensions of kinetic simulation codes are carried out for evaluating NC & GK turbulent transport in LHD and other devices.
- **Hybrid simulation code, MEGA, has been successfully applied to investigate energetic-particle driven instabilities and resultant transport of energetic particles in LHD, DIII-D, and ITER.**
- Simulation codes to investigate peripheral plasma transport and plasma-wall interactions are developed and validated by comparisons with experimental results.
- Extensions and applications of integrated simulation suites, TASK3D-a (analysis) and TASK3D-p (prediction), have been further advanced. They have contributed to physics interpretations of LHD plasmas and the quantitative assessment of FFHR-d1 design.

3D properties of energetic-particle driven instabilities in LHD were clarified

- Energetic-particle driven geodesic acoustic mode (EGAM) has been simulated with MEGA code for a 3D LHD equilibrium.
- Good agreement was found with the EGAM frequency observed in the experiment. The spatial profile consists of m/n=0/0, 1/0, and 2/10 components.

Invited talk at the 9th International West Lake Symposium (2015)

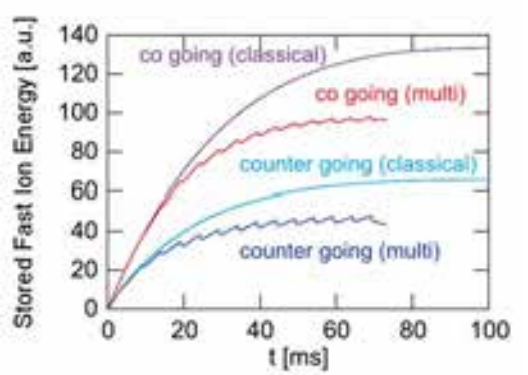


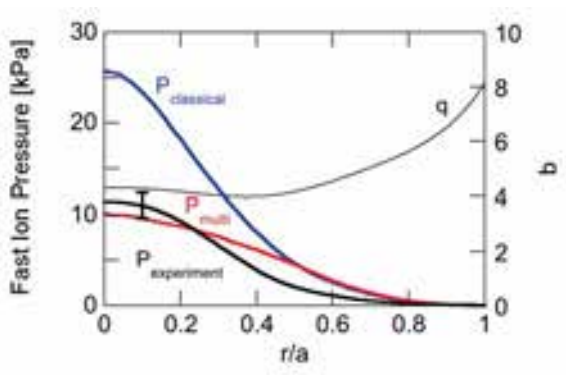


- Energetic-particle transport due to Alfvén eigenmodes were studied with kinetic surface-of-section plots (right).
- Particle transport width was compared with the experiment, and the AE amplitude was inferred.

Multi-phase hybrid simulation method was developed to simulate the EP nonlinear dynamics on the slowing down time scale

- The MEGA code is run without MHD perturbations in the classical phase, while the interaction between the energetic particles and the MHD fluid is simulated in the hybrid phase. This combination is continued until a steady state appears.
- Applied to DIII-D discharge #142111 where the fast ion spatial profile is significantly flattened due to multiple Alfvén eigenmodes (AEs).

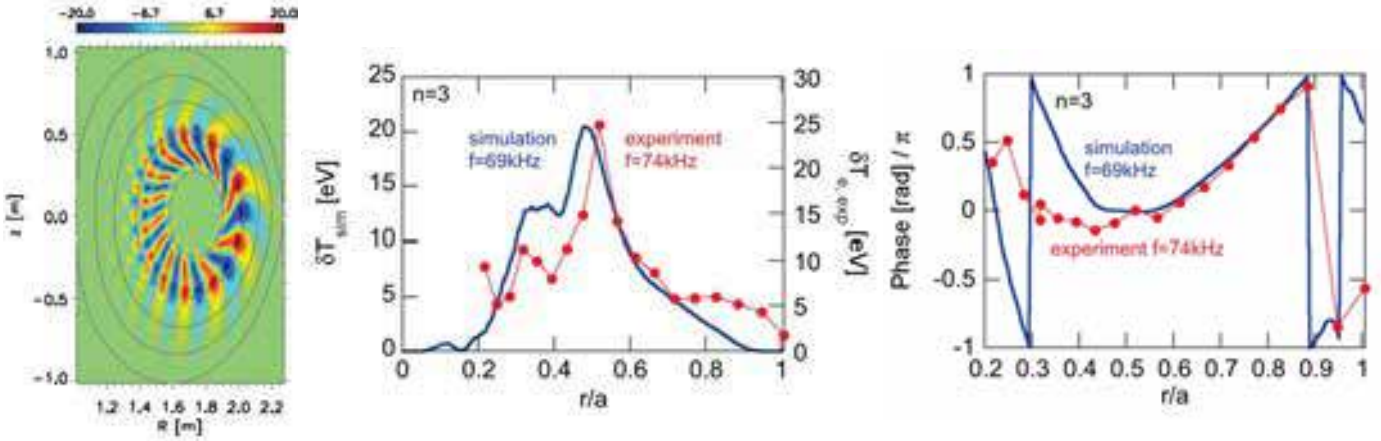




- The large fast ion pressure profile flattening observed experimentally was successfully reproduced by these first of a kind comprehensive simulations.

Multi-phase hybrid simulation was validated for temperature fluctuations in a DIII-D experiment

- Temperature fluctuations due to three of the dominant toroidal Alfvén eigenmodes in the simulation results were compared in detail with electron cyclotron emission measurements in the experiment.

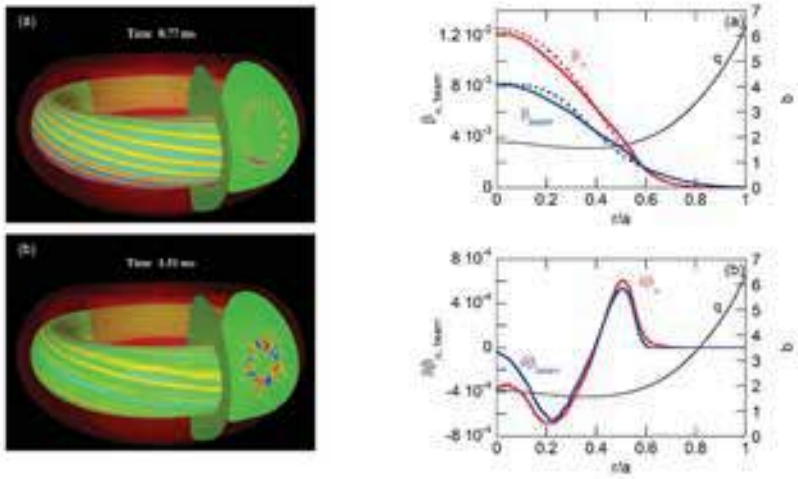


- It was demonstrated that the temperature fluctuation profile and the phase profile are in very good agreement with the measurement, and the amplitude is also in agreement within a factor of two for all the modes.
- This level of agreement validates the multi-phase hybrid simulation for the prediction of AE activity and alpha particle transport in burning plasmas.

Oral presentation at the 25th IAEA FEC (2014)

Alfvén eigenmodes were found unstable, but the energetic-particle transport is benign for ITER 9MA scenario

- Energetic-particle driven instabilities were investigated for the ITER baseline (15MA) and steady-state (9MA) scenarios using MEGA code.



- 9MA scenario
  - TAEs with n~13-17 and BAEs with n~3-5 were found unstable.
  - Redistribution of energetic particles with $\delta\beta_\alpha$~0.07% and $\delta\beta_{beam}$~0.07%, which are 6% and 8% of the central values, respectively.
- 15MA scenario
  - No significant AE activity and negligible EP redistribution if q>1.

Summary of research achievements in simulations of energetic particles and waves

- 3D properties of energetic-particle driven geodesic acoustic modes and Alfvén eigenmodes in LHD were clarified with MEGA code.
- Multi-phase hybrid simulation method was developed, which can simulate energetic-particle nonlinear dynamics on the slowing down time scale.
- Fast ion pressure profile flattening and temperature fluctuations due to the toroidal Alfvén eigenmodes observed in DIII-D were successfully reproduced by the multi-phase hybrid simulation using MEGA code.
- MEGA code was applied to investigate energetic-particle driven instabilities for ITER operation scenarios.
- The 20th JSPF Award for Notable Contribution to Technology (2015) was presented for "Development of MEGA, Hybrid Simulation Code for Energetic Particles and MHD."

Contributions to the Numerical Test Reactor for a helical fusion system

- For identification of key physics determining stability boundary in heliotrons, effects of RMP, viscosity, heat conductivity, and diamagnetic rotation on the global stability in LHD and FFHR are clarified by MHD simulations.
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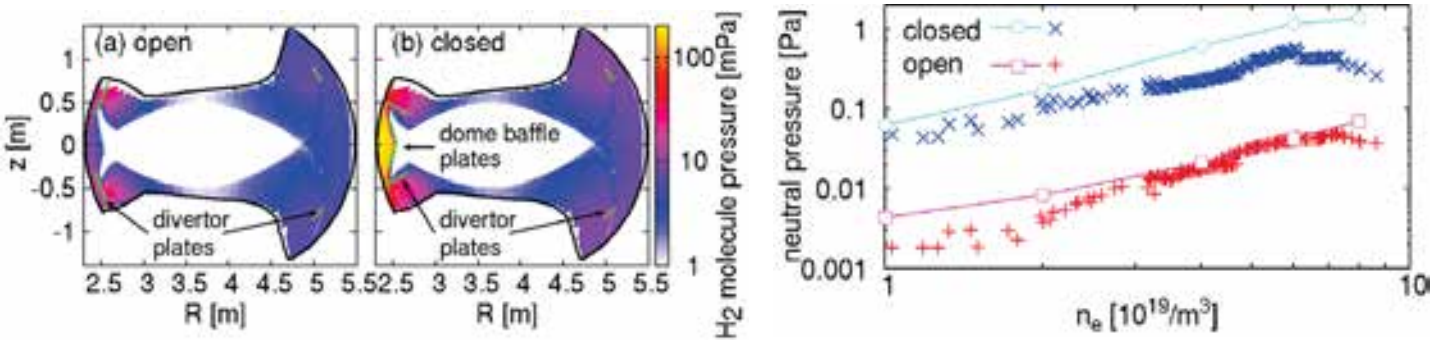
- Extensions and applications of integrated simulation suites, TASK3D-a (analysis) and TASK3D-p (prediction), have been further advanced. They have contributed to physics interpretations of LHD plasmas and the quantitative assessment of FFHR-d1 design.

Compression of neutrals by closed divertor is successfully demonstrated by EMC3-EIRENE code

- Transport of LHD peripheral plasma and neutrals has been modeled by EMC3-EIRENE code developed in Max-Planck IPP.
- A calculation mesh covering the ergodic and leg regions has been developed.

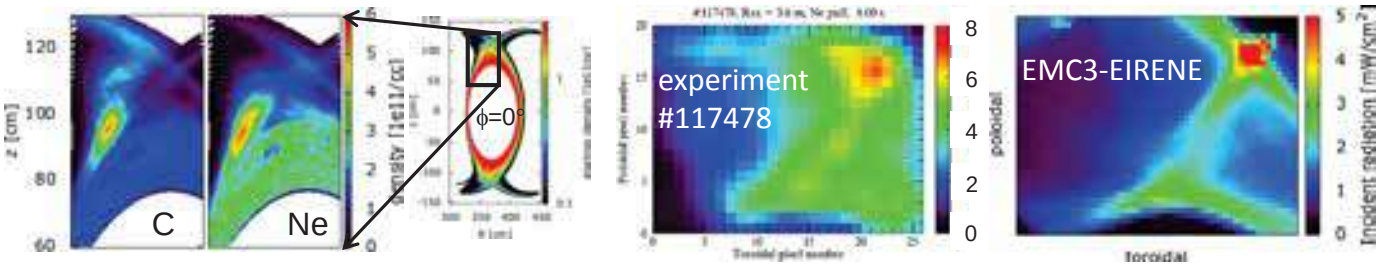


[G. Kawamura et al., Proc. 25th IAEA-FEC 2014, TH/P6-39]

- The closed structure causes one order higher neutral pressure under the dome by compression of the gas and larger recycling.
- Good agreement with experiment results of a pressure gauge under the dome has been obtained with respect to the compression ratio and the scaling of the pressure on electron density at the LCFS.

Impurity transport is analyzed in a discharge with neon gas-puff and it is validated by bolometer measurement

- Impurity transport is simulated in a steady state plasma after a gas-puff in the discharge #117478 by EMC3-EIRENE code.
- Validation with bolometer measurement from the 6.5U port has been made.



[G. Kawamura et al., PET15 Workshop, I-03, 2015 (invited talk)]

- Accumulation of neon in the ergodic region takes place because of deeper penetration of neon neutral atom and large thermal force in the ergodic region.
- A strong peak of carbon and neon ions is caused by parallel transport from the strike point with high particle flux of hydrogen ion.
- The synthetic image of radiation from neon, carbon, and hydrogen has good agreement with the bolometer measurement.

Spatial change of cross-field transport in the stochastic layer is identified by EMC3-EIRENE code

- 3D edge transport code EMC3 has been extended to execute non-uniform cross field transport with implicit scheme.
- Benchmark of the new code version with analytical solution and finite difference methods has been finished.

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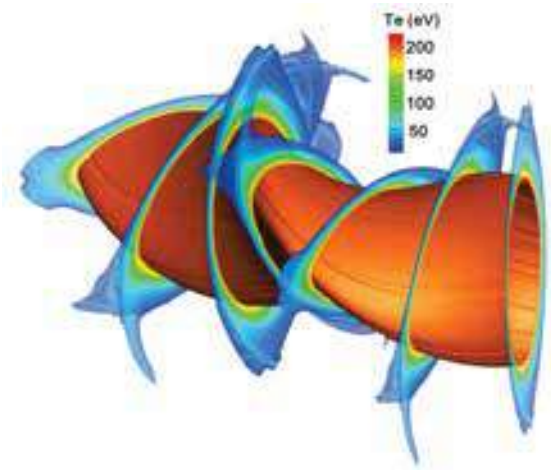
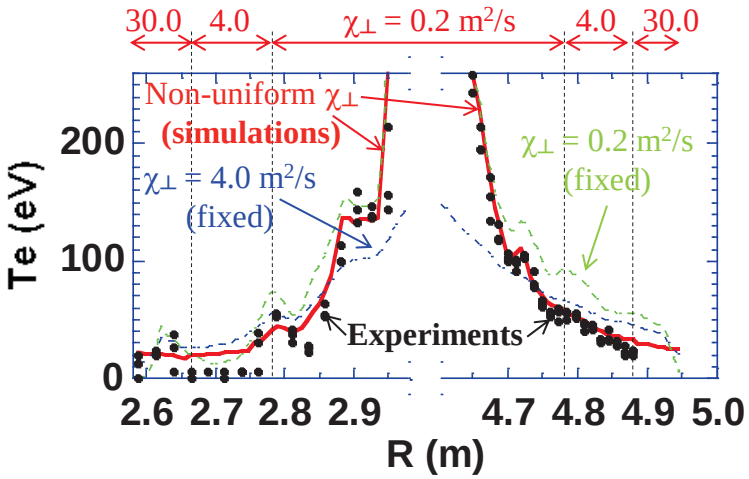
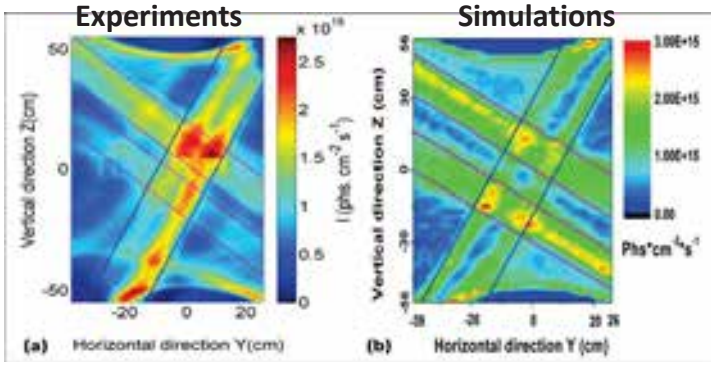




- The first implementation in the edge stochastic layers of LHD to analyze spatial change of cross-field transport has been conducted.
- Clear change of cross-field transport in the stochastic layer has been identified. (M. Kobayashi et al., Contrib. Plasma Phys. **54** (2014) 383.)

Impurity transport model with systematic parameter scan is studied in direct comparison with experiments

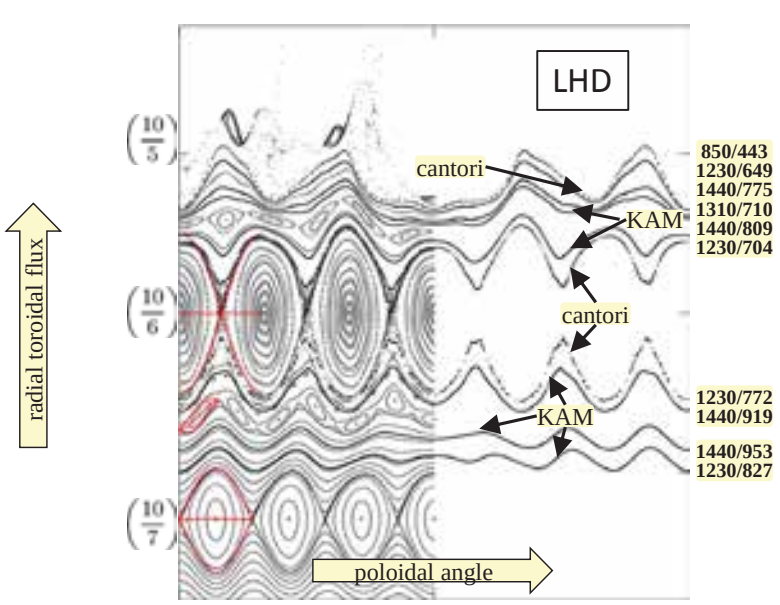
- The EUV spectrometer system has been successfully calibrated to provide absolute emissivity → Direct comparison with EMC3-EIRENE simulation becomes possible
- Global structure of impurity emission is reproduced with the simulation ← The structure is identified as due to the divertor legs and edge magnetic field structure in stochastic region.

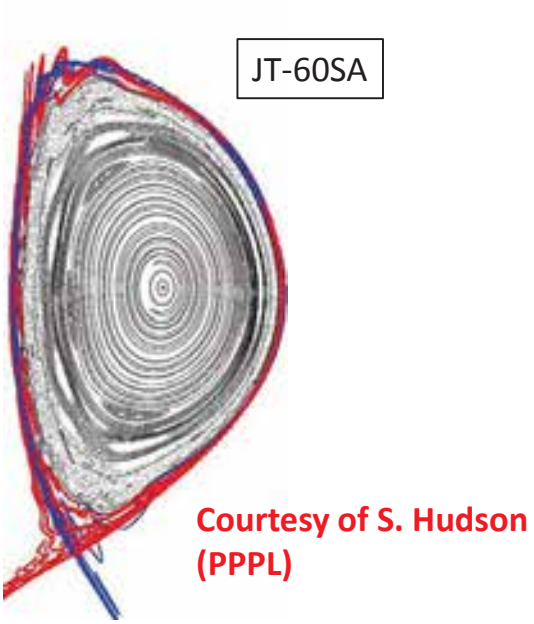


- The absolute comparison of emissivity revealed that the impurity sputtering yield should be around 1%.
- The 2D pattern of emission is found to be very sensitive to impurity source location, i.e., either divertor or first wall. (S.Y. Dai et al., PET2015, accepted by Contrib. Plasma Phys.)

Theoretical study of magnetic field lines and heat transport in strongly stochastic field is improved

- Near the edge, there is a fractal mix of low-order islands, high-order islands, KAM surfaces, cantori, etc.





Courtesy of S. Hudson (PPPL)

- KAM surfaces can be worked as barriers of the heat transport.

Three-dimensional trajectories of dusts in LHD plasma were calculated by a dust transport simulation code

- Three-dimensional trajectories of carbon dusts in LHD long pulse discharge were analyzed.
- A dust transport simulation code (DUSTT) was applied by collaboration with Kanazawa Univ. and UCSD in the USA.

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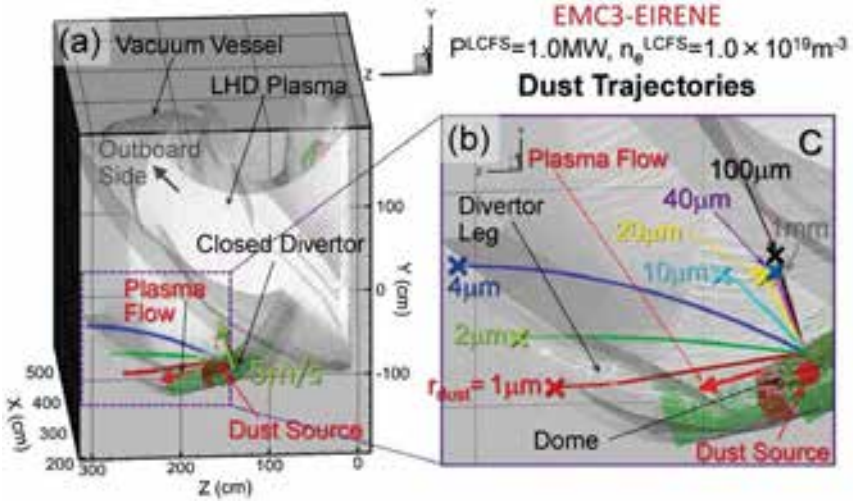
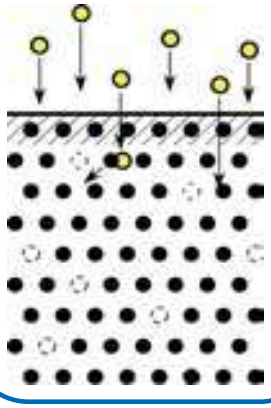


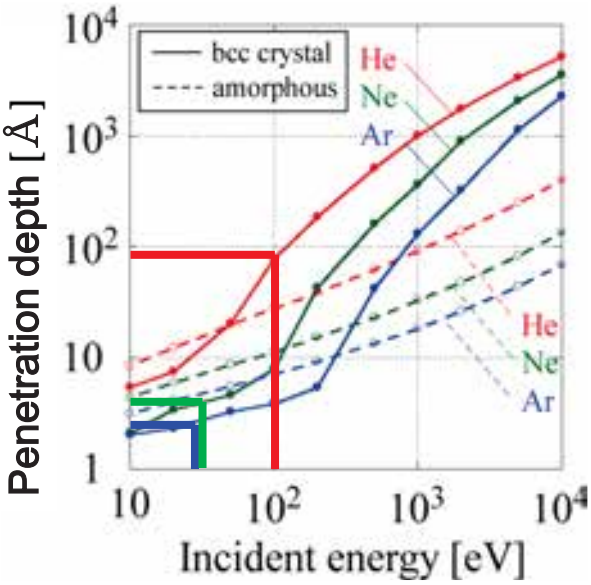
- Small dusts (r_d<4μm) are swept away by the plasma flow (ion-drug force) on divertor legs.
- Medium dusts (r_d<100μm) evaporate in the ergodic layer, but the giant dust (r_d=1mm) penetrates into the main plasma.

By Binary Collision Approximation (BCA) simulation, it is found that only He can invade tungsten, but Ne and Ar cannot

- We used Binary Collision Approximation (BCA) to analyze the invasion process of rare gases into the tungsten.

Invasion process:
stopping range vs. sputtering





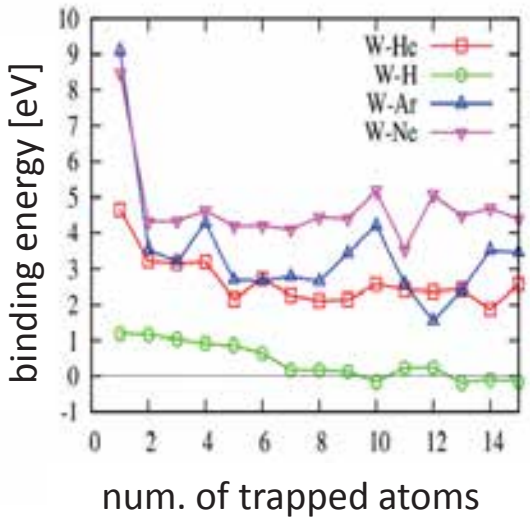
	Typical Penetration depth
He	100 Å
Ne	6 Å
Ar	4 Å

cf. Lattice constant of Tungsten = 3.1 Å

- For the helium, the sputtering threshold energy is around 100 eV. Neon is 60 eV. Argon is 50 eV.
- The penetration depth of helium is 100 Å. Ne is 6 Å, and Ar is 4 Å. Comparing the lattice constant of tungsten 3.1 Å, Ne and Ar cannot invade the tungsten.

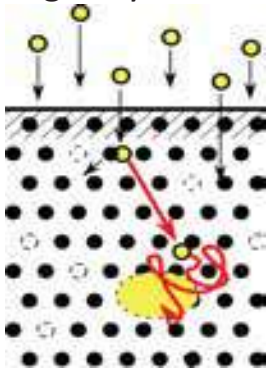
Using Density Functional Theory (DFT) simulation, we discovered that noble gases (He, Ne, Ar) can aggregate in tungsten, but H cannot

- Using Density Functional Theory (DFT) Simulation, the binding energy of noble gases in tungsten is calculated.



A. Takayama *et al.*, JJAP **52** (2013) 01AL03.

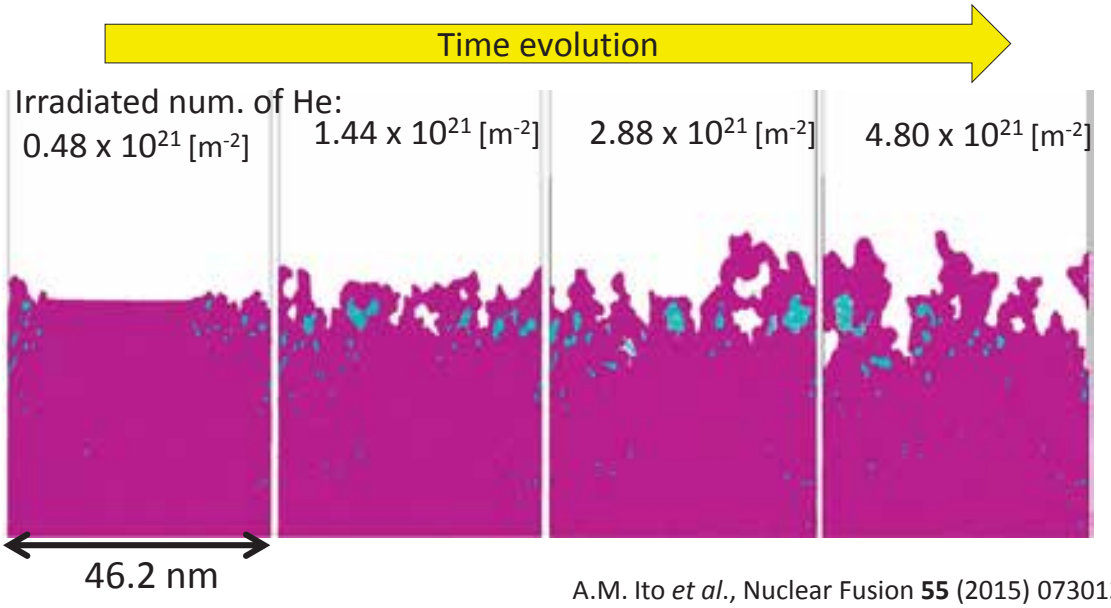
Diffusion and capture process:
Noble gases diffuse in tungsten and are caught by vacancy.



- As the number is increasing, the binding energies of hydrogen are negative. However, the binding energy of noble gases do not become negative in this range.
- Only hydrogen cannot agglomerate in a mono vacancy of tungsten.

The initial stage of fuzz nanostructure formation can be reproduced by MC-MD hybrid simulation

- Using Monte-Carlo and Molecular Dynamics Hybrid Simulation, we succeeded in reproducing the initial stage of fuzz structure formation



A.M. Ito *et al.*, Nuclear Fusion **55** (2015) 073013
A.M. Ito *et al.*, J. Nucl. Mater. **463** (2015) 109.

- As the irradiated He (blue balls) is increased, tungsten (purple balls) is changing from the flat surface to the fuzz surface.

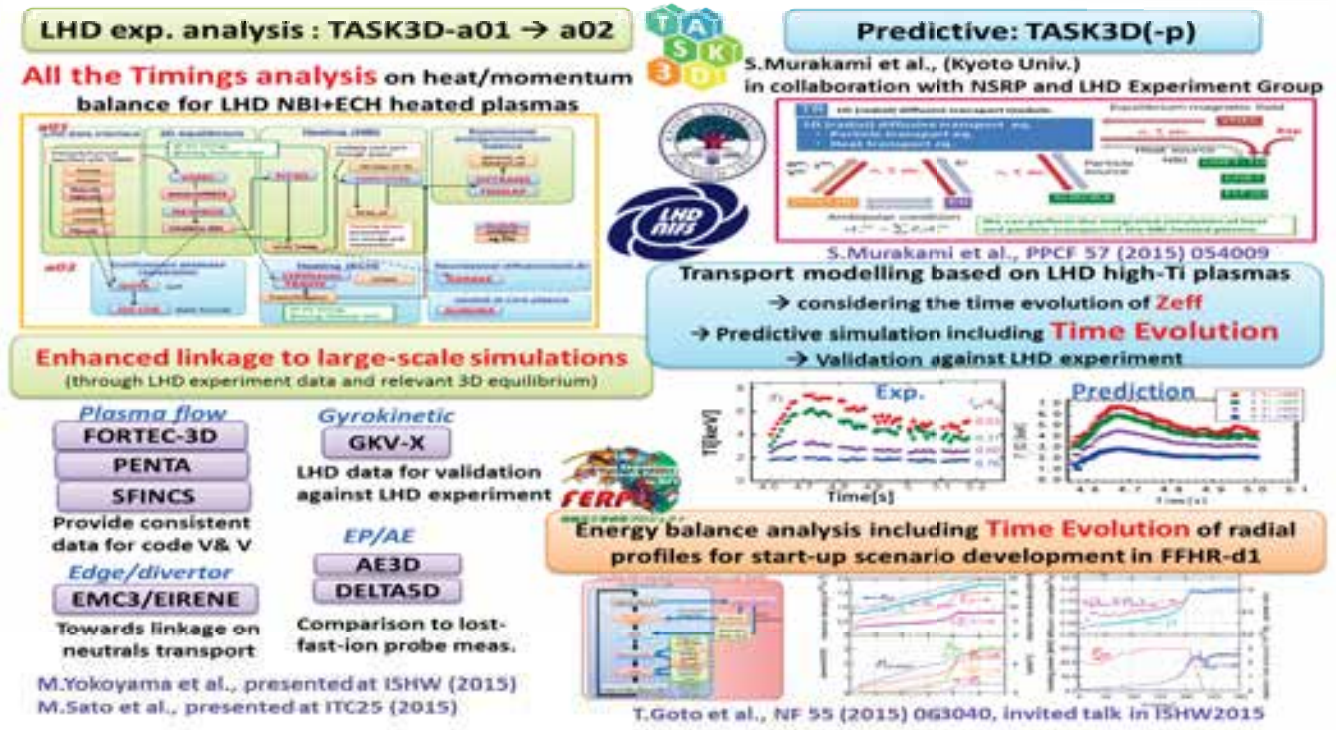
Summary of research achievements in simulations of peripheral plasmas and plasma-wall interaction

- Transport simulations of neutral particles and impurities in LHD peripheral regions are successfully validated by comparisons with experimental results.
- Theoretical and experimental studies on heat transport across stochastic field lines are advanced.
- Three-dimensional trajectories of dusts in LHD plasma are illustrated by a dust transport simulation code.
- Penetration depths and binding energies of He, Ne, and Ar irradiated into W are evaluated by BCA and DFT simulations.
- Monte-Carlo and molecular dynamics hybrid simulation reproduces formation of fuzz nanostructure observed in He-irradiated W.

Contributions to the Numerical Test Reactor for a helical fusion system

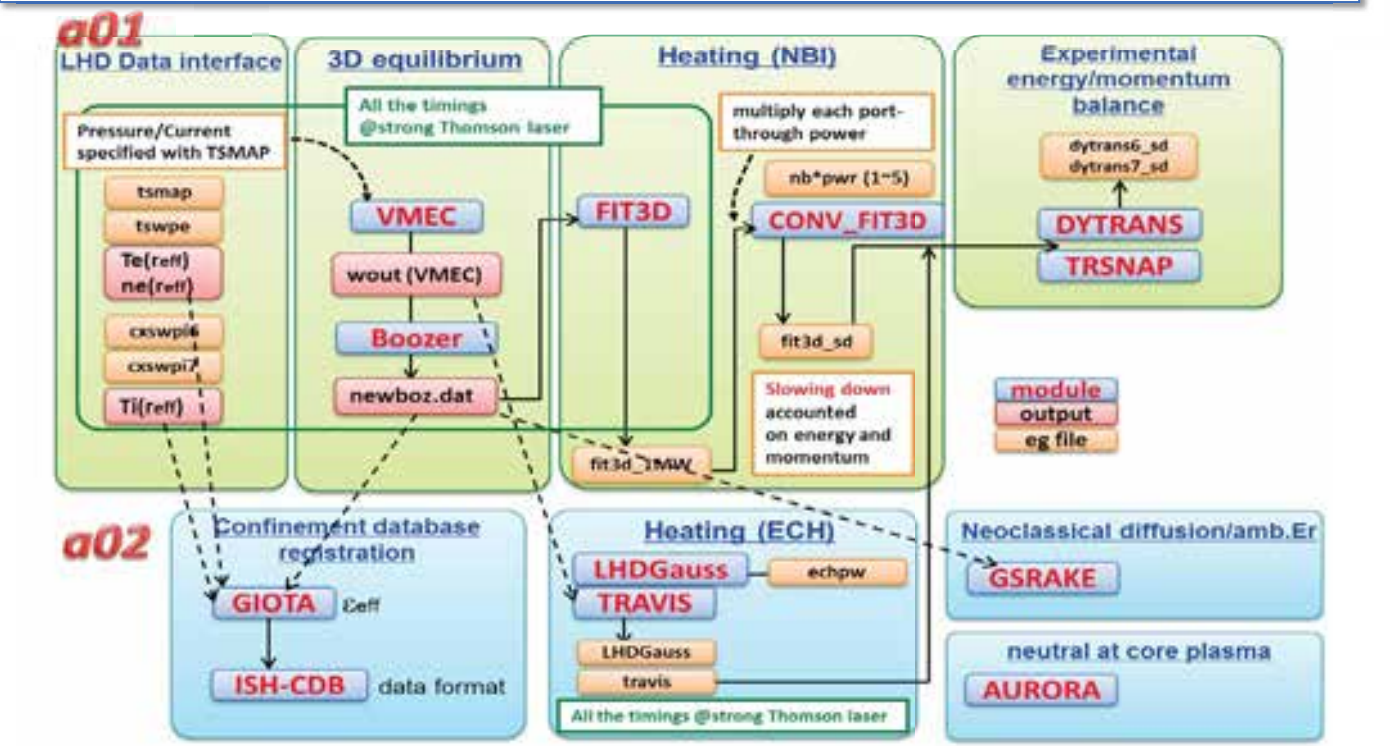
- For identification of key physics determining stability boundary in heliotrons, effects of RMP, viscosity, heat conductivity, and diamagnetic rotation on the global stability in LHD and FFHR are clarified by MHD simulations.
- V&V studies and extensions of kinetic simulation codes are carried out for evaluating NC & GK turbulent transport in LHD and other devices.
- Hybrid simulation code, MEGA, has been successfully applied to investigate energetic-particle driven instabilities and resultant transport of energetic particles in LHD, DIII-D, and ITER.
- Simulation codes to investigate peripheral plasma transport and plasma-wall interactions are developed and validated by comparisons with experimental results.
- **Extensions and applications of integrated simulation suites, TASK3D-a (analysis) and TASK3D-p (prediction), have been further advanced. They have contributed to physics interpretations of LHD plasmas and the quantitative assessment of FFHR-d1 design.**

Overview of highlighted progress related to integrated transport analysis suite, TASK3D (progress in 3 years)



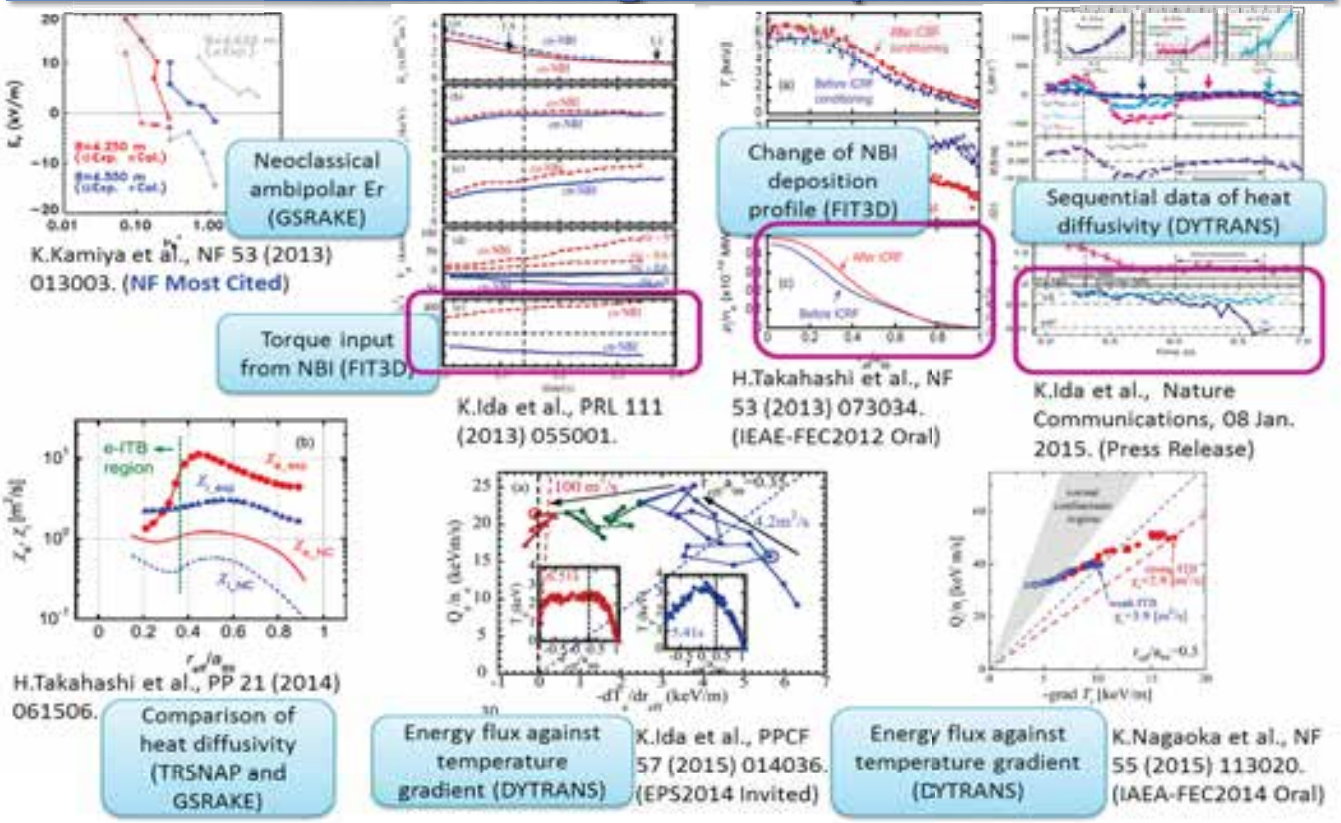
- Substantial progress has been made both for analysis and predictive versions based on collaborations with LHD Exp. G, FERP, and Kyoto University.
- Keywords: All the timing, time evolution, and linkage to large-scale simulation

TASK3D-a (analysis) has progressed to be more capable



- TASK3D-a01 was released in Sept. 2012. (applicable only to NBI-heated plasmas)
- Now, it has been extended to include modules for confinement database registration, **ECH**, neoclassical diffusion/ambipolar Er, and core neutral transport. English manual also has been extended for international collaboration.

TASK3D-a has contributed to increasing physics understandings of LHD plasmas



- Extended TASK3D-a has contributed to providing **multi-timing (dynamic), time evolution results** in LHD publications (NUCLEAR FUSION most cited paper, Press releases, Invited talks in major conferences, etc.) in the last three years.

TASK3D-a collaborations have been enhanced

Princeton Plasma Physics Laboratory
N.Pablant
Application to high-Te LHD plasmas
Invited talks in International Stellarator-Heliotron Workshop (2013, 2015)

RFX Consortium
P.Vincenzi
(NIFS stay by EUROfusion budget)
Update of NBI modules in TASK3D-a
(Multi-ion species, Neutron production rate)
Poster in EPS2015 and ITC25 (2015)

Oak Ridge National Laboratory
D.A.Spong
Delivering of PENTA code
(neoclassical plasma flow analysis)
in loose coupling with TASK3D-a

Tech-X Corporation
A.Y.Pankin
Uncertainty Quantification (UQ) by establishing link between TASK3D-a and DAKOTA suite
Oral talk in APS 2014

International Stellarator-Heliotron Confinement and Profile Database
(ISH-CDB and PDB)
Registration of LHD experiment data
→ Enhancing code V & V

(Domestic) **Symposium on operation controls in DEMO**

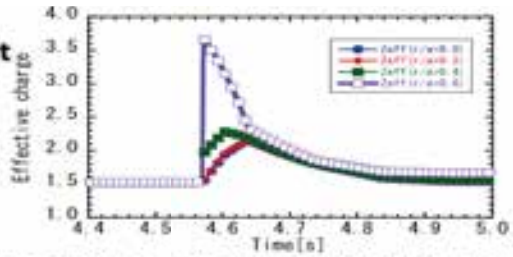
- TASK3D-a has actively played a role as the interface of international collaborations on LHD experiment analyses
- Enhanced collaborations have produced several conference presentations by collaborators.

TASK3D-p (predictive @Kyoto U.) has been productive for transport modelling of LHD high-Ti plasmas

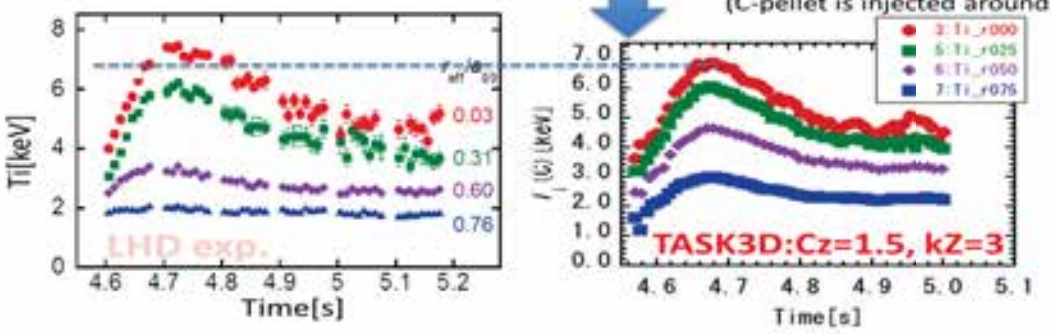
- TASK3D-p has been applied to LHD high-Ti plasmas to deduce relevant transport model including time evolution of Zeff (relevant for Carbon-pellet injection)

Zeff-dependent model for turbulent transport

$$\chi_i^{TB} = \gamma_{Z2}\chi_i^{TB(L-mode)}$$
$$\gamma_{Z2} = \exp\{-k_Z(Z_{eff} - C_Z)\}, \quad Z_{eff} > C_Z$$
$$= 1.0, \quad Z_{eff} \le C_Z$$



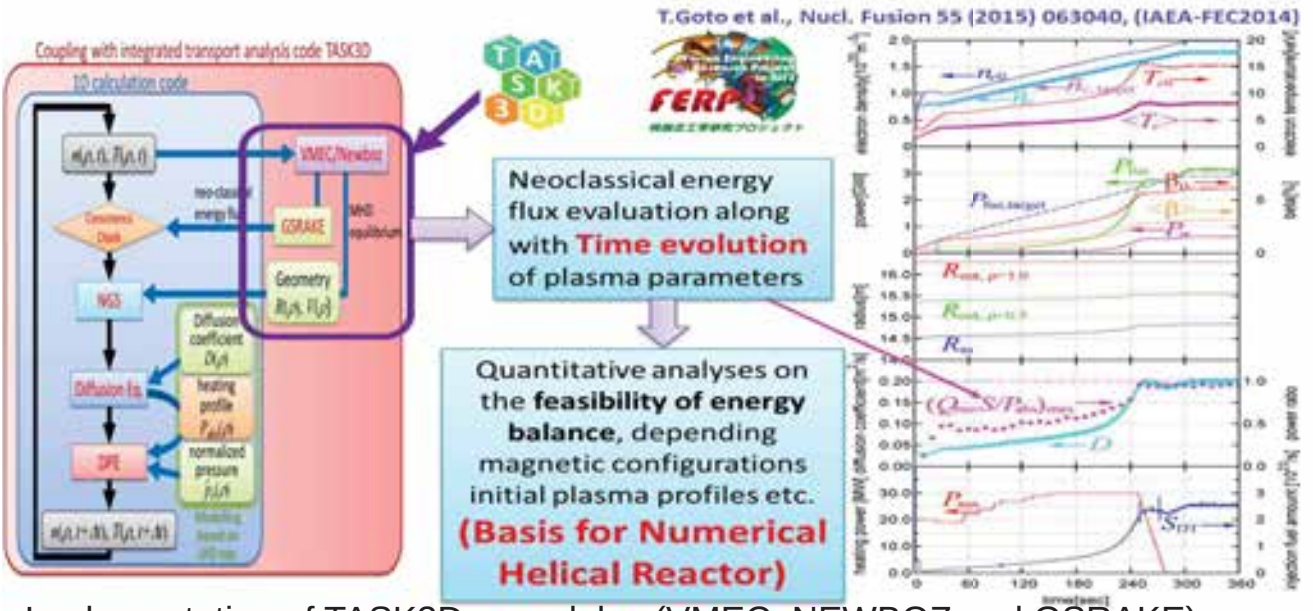
Time evolution of Zeff in a high-Ti LHD plasma
(C-pellet is injected around 4.57s in this case)



- Zeff-dependent model for turbulent χ_i has been empirically deduced
- The time evolution of Ti is quantitatively reproduced with this model
- Theoretical interpretation and predictions for higher performance LHD plasmas are foreseen.

TASK3D-p (NIFS) has progressed to perform FFHR-d1 start-up scenario

- Feasibility study for start-up scenario of FFHR-d1 has been performed in FERP based on 1D transport analysis (Direct Profile Extrapolation (DPE) approach)



- Implementation of TASK3D-a modules (VMEC, NEWBOZ and GSRAKE)
- It has made it possible to perform neoclassical energy flux evaluation along with the **time evolution of plasma parameters**, and to check the feasibility from the viewpoint of energy balance

- **Basis of Numerical Helical Reactor**, based on close collaboration with FERP

Summary of research achievements in integrated simulation code studies

- An integrated transport analysis suite, TASK3D-a, has been further extended to increase its capability (confinement database registration, ECH, neoclassical diffusion/ambipolar Er, and core neutral transport).
- The TASK3D-a suite contributes to a large number of transport analyses of LHD experimental results, to increase physics understandings.
- Wide-ranging international collaborations have been conducted based on TASK3D-a.
- The predictive versions (Kyoto U. and NIFS) have also progressed to the reproduction of time-evolving LHD high-Ti plasmas, and the prediction of the start-up scenario of FFHR-d1.
- The keywords for these three years of progress are
  - All the timing of a complete discharge (analysis)
  - time evolution (analysis and prediction), and
  - linkage to large-scale simulation (analysis: unified basis for analyses of LHD plasmas)

2. Research achievements

Does the NSRP produce high-level achievements in accordance with international standards for the following research areas by promoting theory and computer simulation research utilizing the Plasma Simulator?

(2) **Physics mechanisms of fusion plasmas and their theoretical systemization**

NSRP has produced high-level achievements in theory and computer simulation research contributing to elucidation of physics mechanisms of fusion plasmas and their systemization in the following areas:

- **Nonlinear MHD and extended MHD physics**
- Micro Physics and Modeling

Full 3D simulation of ballooning modes in LHD revealed enhancement of instability

- Fully three-dimensional simulation of extended (two-fluid) MHD are carried out with a numerical filter to remove high-n whistler and other fast waves.
- This study is aimed at clarifying how the Hall (two-fluid) term can change th growth of the ballooning instability in LHD.

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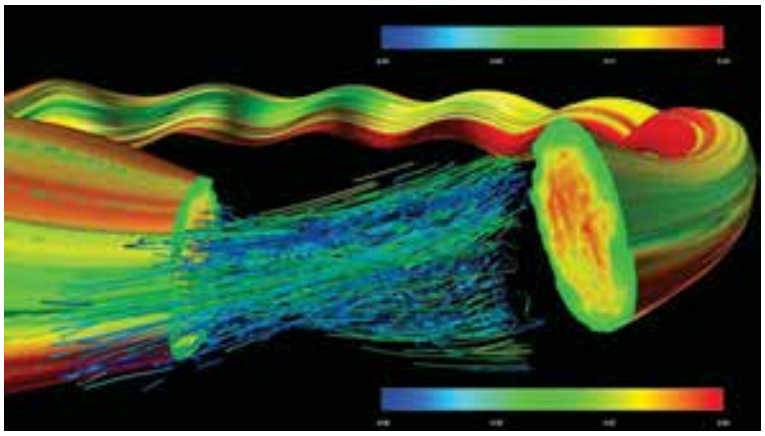
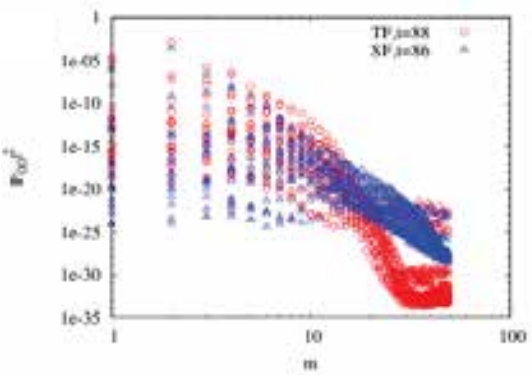
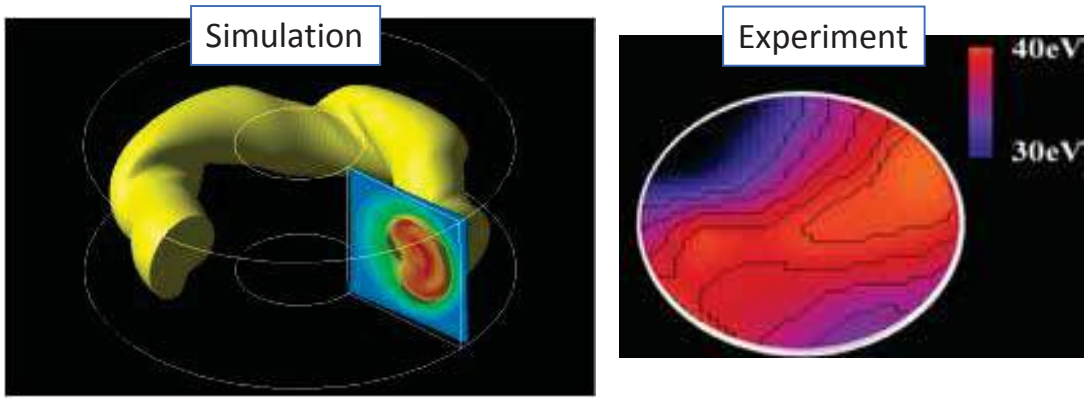




- The simulations shows that the two-fluid term can enhance the instability and that saturated profile can be worse than the single-fluid MHD simulations.
- The removal of high-n modes can enhance the growth of low-modes. This suggests the necessity of strong couplings between high- and low-modes for mild saturations.

MIPS simulation on helical states in RFP was verified with experiments and NIMROD analysis

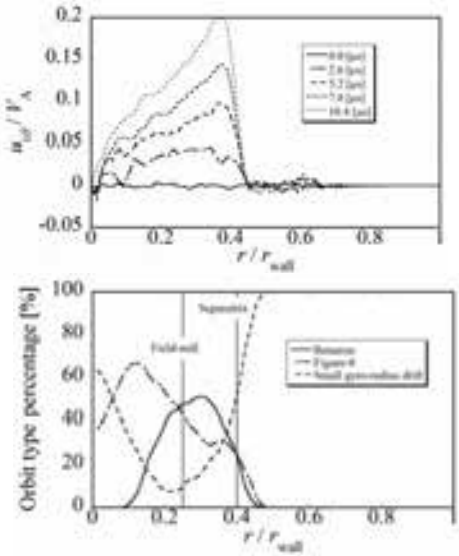
- Formation of helical structure in the RFP experimental configuration was reproduced by MIPS nonlinear simulation.
- Results are compared with the SXR measurement in RELAX device and NIMROD simulation.

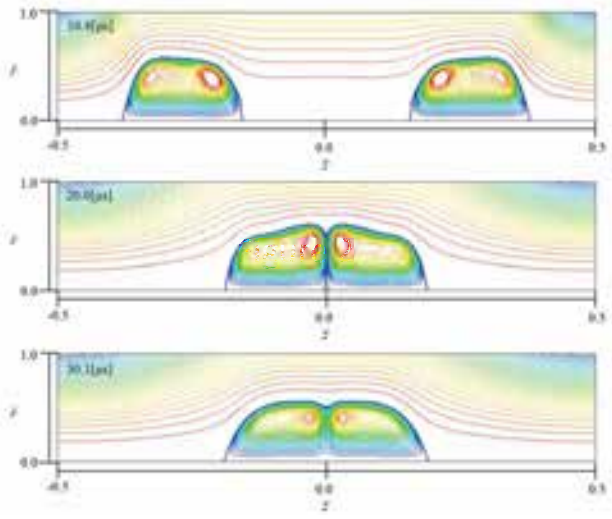


- The m=1/n=4 deformation are observed both in the MIPS simulation and in the experiment.
- Qualitative agreements are seen between MIPS and NIMROD results. Higher mode components are dominant in the NIMROD result.

Resistive MHD and hybrid simulations of high-beta self-organized plasmas

- Origin of toroidal spin-up of high-beta field-reversed configuration (FRC) is investigated by hybrid simulation.
- Axial collision of two FRCs is simulated by using a resistive MHD model.

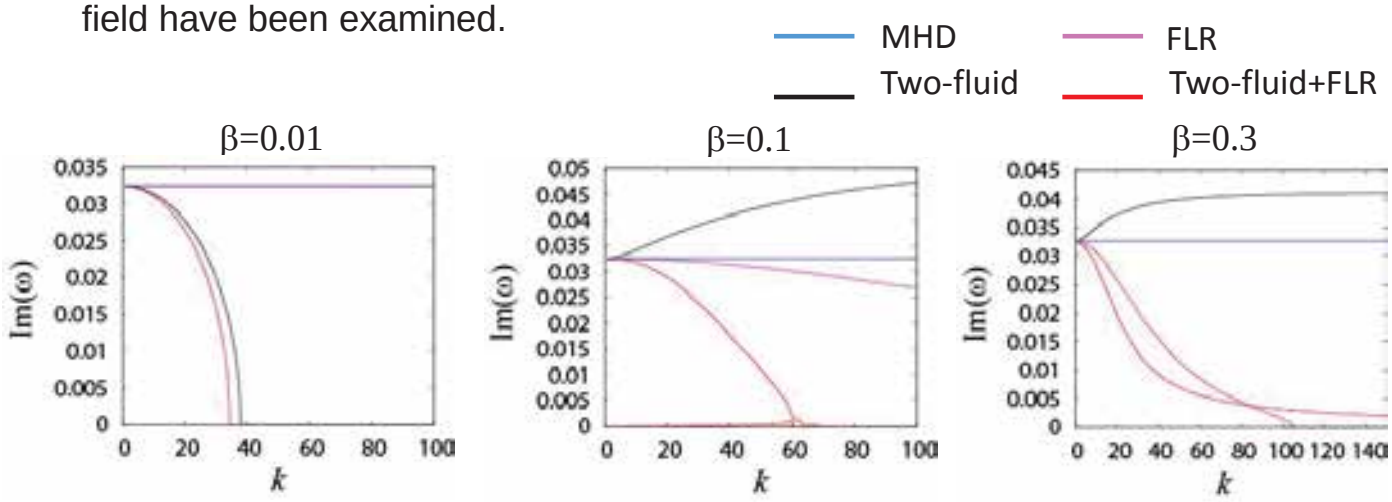




- Gradual toroidal spin-up results from acceleration of betatron particles by the toroidal inductive electric field.
- An anomalous resistivity in the reconnection region is needed to complete a merging process of two FRCs.

Two-fluid and finite Larmor radius effects on Rayleigh-Taylor instability in non-uniform magnetic field show complicated beta dependence

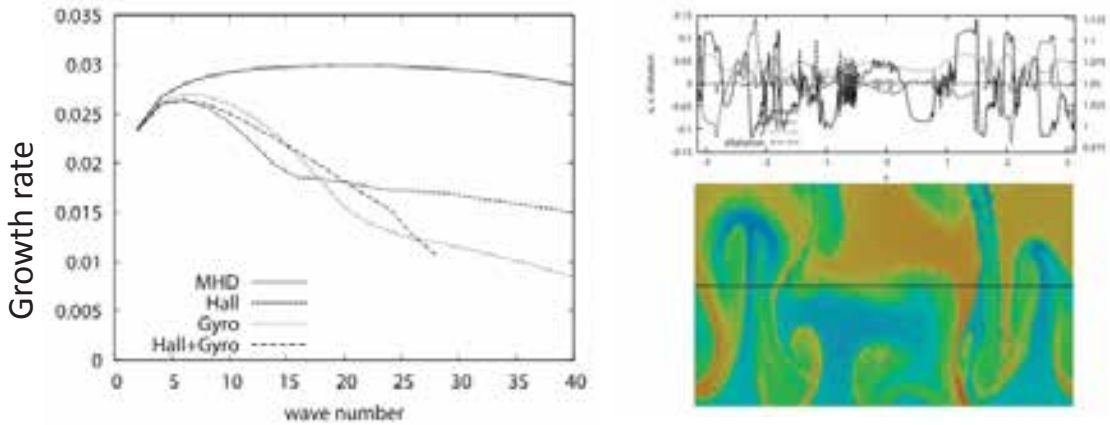
- Two-fluid and finite Larmor radius effects on large wavenumber modes of Rayleigh-Taylor instability in finite beta equilibrium with non-uniform magnetic field have been examined.



- Strong FLR stabilization occurs for high beta
- Two-fluid effect is stabilizing for low beta, but is destabilizing for high beta
- Coupling of FLR and two-fluid effects indicates strong stabilization for low beta, but is less stabilizing for large wavenumber modes than the FLR effect for high beta

Extended MHD simulation of 2D Rayleigh-Taylor instability revealed excitations of small-scale secondary instability

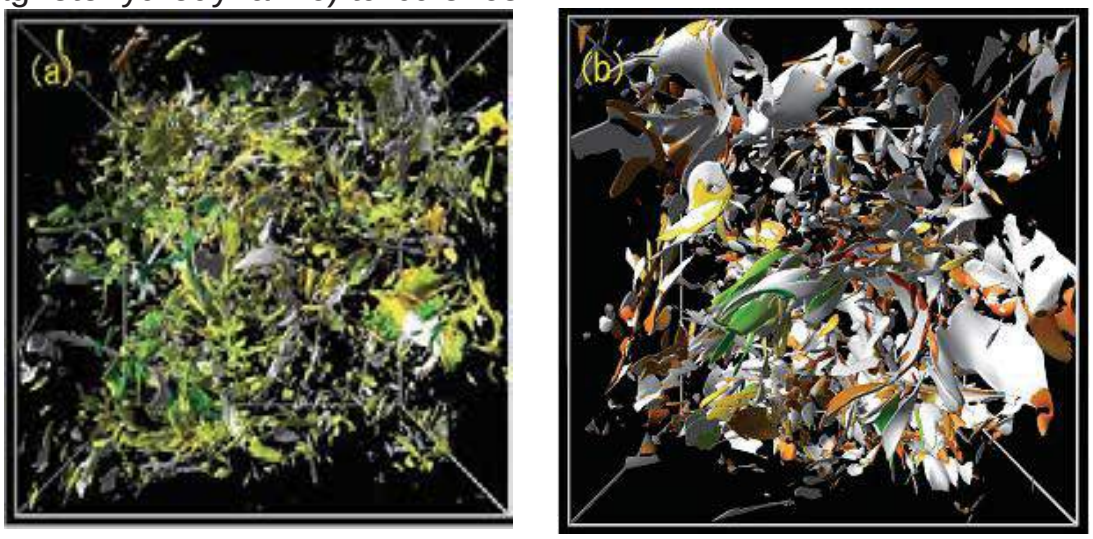
- Roles of the two-fluid and gyro-viscous terms in RT instability are studied.
- This study is aimed at clarifying how the two terms change linear stability, and how the two terms change dynamics in nonlinear stage.



- The combination of the two-fluid and gyro-viscous terms can suppress high-wave number unstable mode completely.
- Suppression of the high modes can bring about growth of the secondary Kelvin-Helmholtz instability and make the field fully turbulent.
- The paper was selected as the featured article in Phys. Plasmas vol.22 issue 3. One of the figure was selected as the front cover image of the March issue.

Structure transition induced by Hall effect is revealed by homogeneous Hall MHD turbulence simulation

- This study is aimed at clarifying how the Hall (two-fluid) term can change spatial structure when the instability is fully moved to (magnetohydrodynamic) turbulence.



- The change of the frozen-in condition releases the velocity field from the magnetic field, and the vortex structure becomes similar to that in hydrodynamic turbulence.
- High wave number components of the Hall term can be replaced by the Smagorinsky-type sub-grid-scale (phenomenological) model.

Summary of research achievements in Nonlinear MHD and extended MHD physics

- Full 3D simulation of ballooning modes in LHD revealed enhancement of instability
- MIPS simulation on helical states in RFP was verified with experiments and NIMROD analysis
- Resistive MHD and hybrid simulations of high-beta self-organized plasmas reveal the necessary condition for FRC merging
- Two-fluid and finite Larmor radius effects on Rayleigh-Taylor instability in non-uniform magnetic field show complicated beta dependence
- XMHD simulation of 2D Rayleigh-Taylor instability revealed excitations of small-scale secondary instability
- Structure transition induced by Hall effect is revealed by homogeneous Hall MHD turbulence simulation

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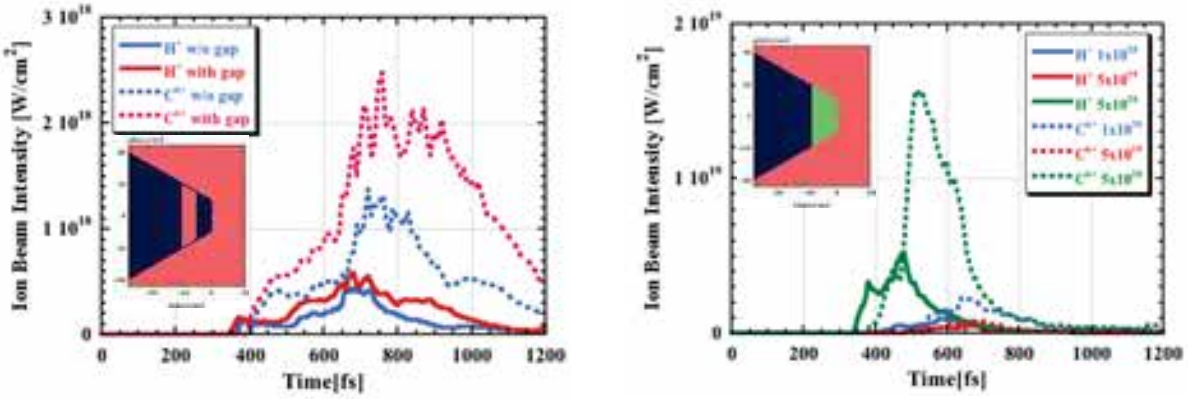
NSRP has produced high-level achievements in theory and computer simulation research contributing to elucidation of physics mechanisms of fusion plasmas and their systemization in the following areas:

- Nonlinear MHD and extended MHD physics
- **Micro Physics and Modeling**

Enhancements of core heating have been achieved using targets for energetic ion assisted fast ignition

- A plastic (CH) thin film or low-density foam is introduced into the cone-guided target to generate energetic proton (H+) and carbon (C6+) beams.
- The thin film is used for the sheath field acceleration at the rear surface, and the low-density foam for the Ponderomotive force acceleration at the front surface.

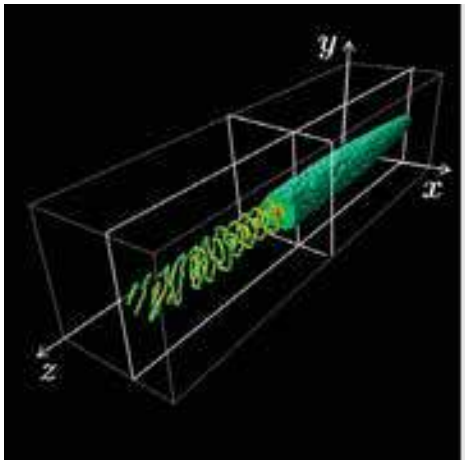


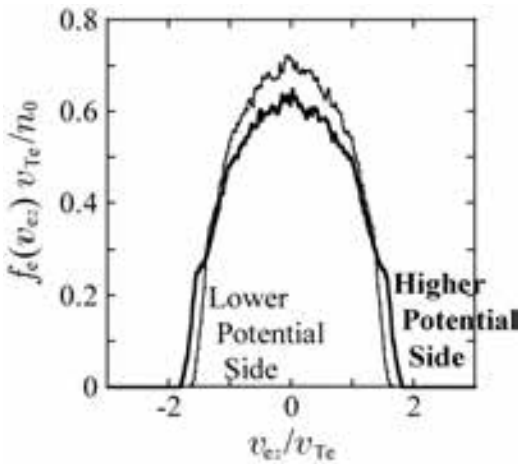
	Sheath Field		Ponderomotive Force		
	w/o gap	with gap	$5x10^{19}$	$1x10^{20}$	$5x10^{20}$
e only	0.15 keV	0.08	0.05	0.11	0.35
e + H^+ + C^{6+}	0.19	0.16	0.06	0.15	0.48
enhancement	27 %	100	20	36	37

- Target design and ion beam intensity are shown for SF(left) and PF(right) in Figs.
- Enhancements of averaged electron core temperature are summarized in Table.

The self-consistent structures in a plasma blob in SOL have been studied with PIC simulations

- The blob propagation dynamics and self-consistent structures in a blob have been studied with p3bd code, which is the three dimensional electrostatic particle simulation code with absorbing particle boundaries.

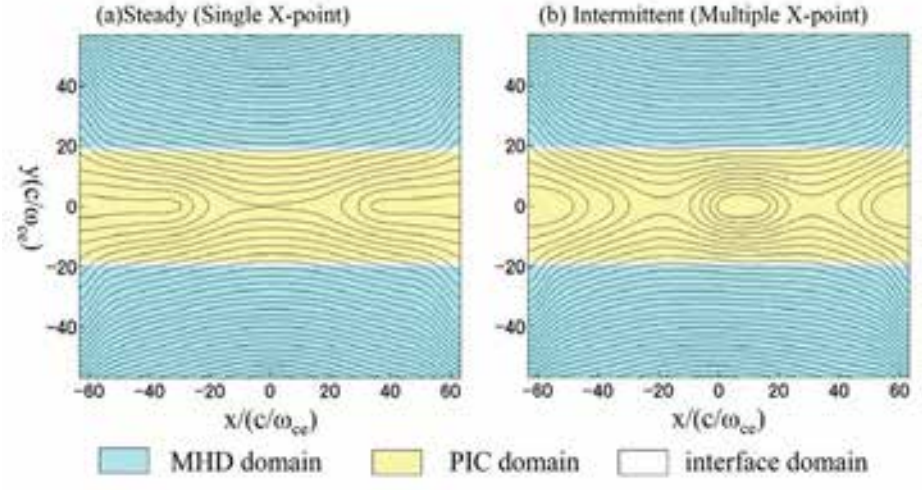




- The self-consistent spiral current system in a blob has been observed.
- This fact indicates that particle simulations are able to provide an exact current closure to analysis of blob dynamics.
- It is found that the electron temperature on the higher potential side is higher than that on the lower potential side.

The influence of macroscopic dynamics on microscopic physics of reconnection is studied with MARIS code

- We carry out simulation runs of magnetic reconnection with different spatial patterns of plasma inflow from the MHD by using MARIS code.

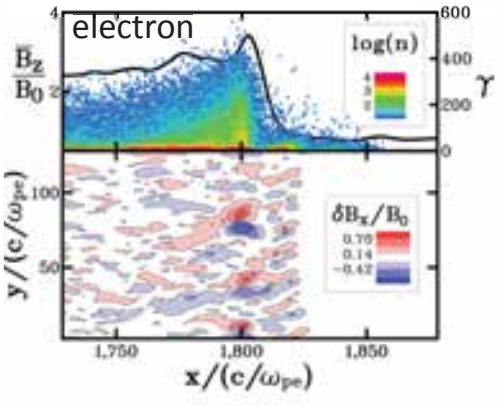


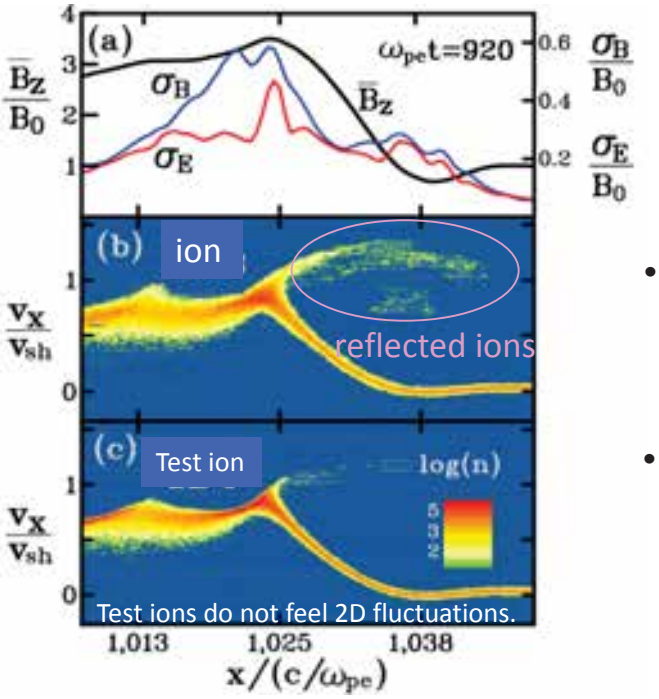
v_w	Result
v_w=0.25 v_{A0}	Single X-point
v_w=0.35 v_{A0}	Multiple X-point
v_w=0.50 v_{A0}	Single X-point
v_w=0.60 v_{A0}	Single X-point
v_w=1.0 v_{A0}	Single X-point
v_w=1.5 v_{A0}	Single X-point
v_w=2.0 v_{A0}	Multiple X-point
v_w=3.0 v_{A0}	Multiple X-point
v_w=4.0 v_{A0}	Multiple X-point
v_w=5.0 v_{A0}	Multiple X-point

- The expanding speed v_w of an MHD inflow controls the aspect ratio of the current sheet and changes behaviors of magnetic reconnection.
- Steady (single X-point) reconnection is driven for $v_w<v_A$ and intermittent (multiple X-point) reconnection occurs in the cases of $v_w>2.0v_A$.

Particle simulation has revealed the interaction of electrons and ions accelerated by a collisionless shock wave

- A magnetosonic shock wave can trap electrons and accelerate them to ultrarelativistic energies. These electrons excite multi-dimensional fluctuations, which significantly influence electron motions.





- Effects of trapped electrons on ion motions in an oblique shock wave have been investigated with particle simulations.
- It is found that the number of accelerated ions via reflection from the shock front is increased because of the multi-dimensional fluctuations excited by the trapped electrons.

Gyrofluid simulation including a new zonal-flow closure model reproduces results of gyrokinetic ITG turbulent transport simulation

- Conventional gyrofluid simulations underestimate zonal flow generation and overestimate ITG turbulent transport (Dimits et al. PoP 2000).
- A new zonal-flow closure model (Sugama et al. PoP 2007) is applied to gyrofluid ITG turbulence simulation (Yamagishi & Sugama, JPS meeting 2015).

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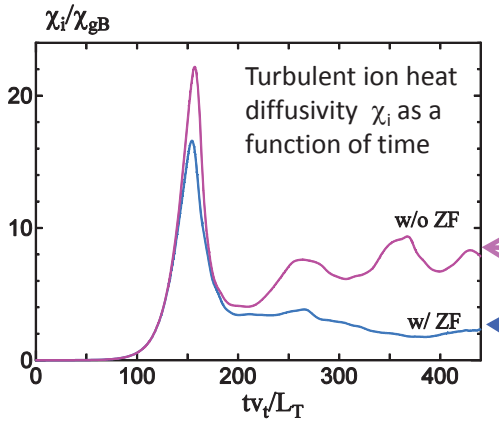
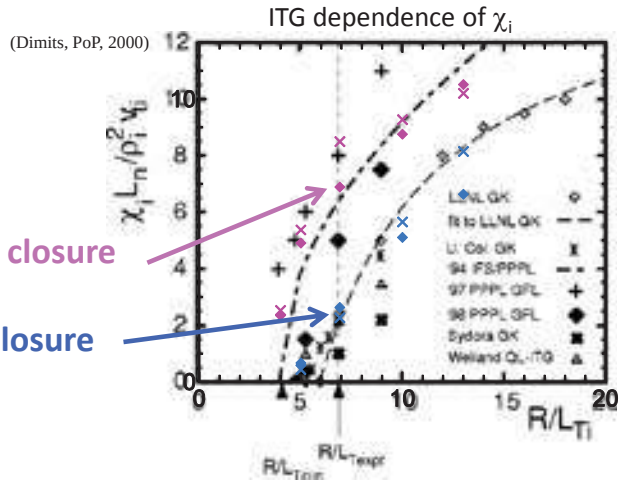


Without ZF closure

With ZF closure



- ITG turbulent heat transport and zonal flows obtained by gyrofluid simulation using the zonal-flow closure model show a good agreement with those by gyrokinetic simulation.

Gyrokinetic field theory is extended to include effects of collisions and time-dependent background magnetic fields

skip

- As a firm foundation of gyrokinetics, gyrokinetic field theory [Sugama, PoP **7** 466 (2000): cited over 100 times (Google Scholar)] presents the variational principle, from which all governing equations for gyrocenter distribution functions and turbulent electromagnetic fields are derived.
- These gyrokinetic equations exactly satisfy phase-space volume invariance and energy conservation for collisionless systems under stationary background magnetic fields.
- Extensions of gyrokinetic field theory are made to include effects of collisions [Sugama et al., PoP **22**, 082306 (2015)] and of time-dependent background magnetic fields [Sugama et al., PoP **21**, 012515 (2014)].
- Extended gyrokinetic equations are shown to keep conservation properties and they can properly describe all processes of classical, neoclassical, and turbulent transport of particles, energy, and toroidal angular momentum in confinement time scale.
- These results are useful for future long-time global gyrokinetic simulations and they are presented in two invited talks for international conferences (2014, 2015).

Modeling of heat diffusivity has been done for dynamical transport simulation

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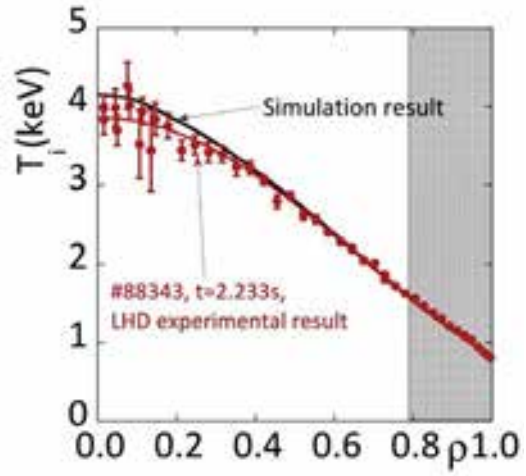
- How to apply the turbulent ion heat diffusivity derived from the gyrokinetic simulation for the transport simulation is shown.
- The dynamical transport simulation (TASK3D-p) is performed using the modeled ion heat diffusivity.

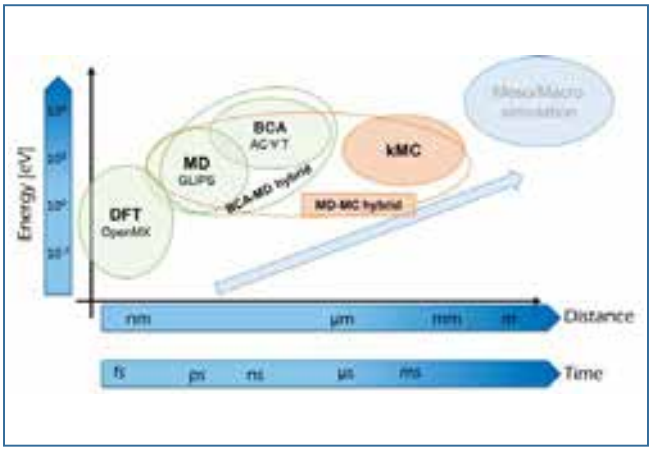


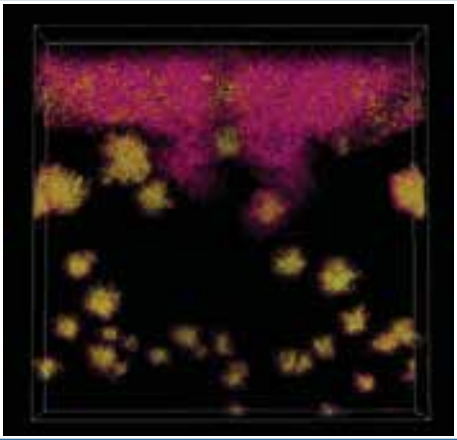
S. Toda et al.,
J. Phys.: Conf. Ser.,
Vol. 561 012020 (2014)

- The ion heat diffusivity is modeled in terms of the linear growth rate and the characteristic time for zonal flows, while the accuracy of the gyrokinetic simulation is adequately maintained.
- The ion temperature profile is shown, which is simulated by TASK3D-p as the stationary state.

A kinetic Monte-Carlo (kMC) code was developed to calculate the diffusion process of He in tungsten in atomic level

- A kinetic Monte-Carlo (kMC) code, which is applicable to longer time-scale event compared to DFT and MD, has been developed.
- Molecular dynamics and Monte-Carlo (MD-MC) hybrid simulation code has been developed.





- The spatiotemporal regime which can be simulated by ourselves has been steadily expanded.
- The kMC code was applied to a situation of tungsten irradiated by helium, and successfully illustrated a helium bubble creation in tungsten.

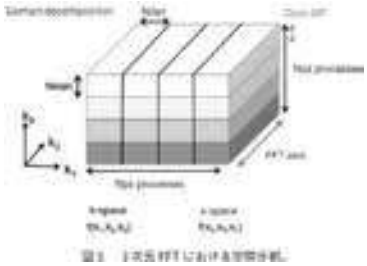
NSRP contributes to theoretical systemization of fusion plasma physics by publishing many review papers

- H. Sugama & T.-H. Watanabe, "*Studies of Turbulence in Magnetized Plasmas Based on Gyrokienetic Theory: From Fusion to Space*," BUTSURI **68**, 296 (2013) [in Japanese]
- R. Horiuchi, "*The Numerical Simulation Research Project at the National Institute for Fusion Science*," J. Plasma Fusion Res. Vol. 90, 2 (2014) [in Japanese]
- A. Ishizawa et al., "*Electromagnetic gyrokinetic simulation of turbulence in torus plasmas*," J. Plasma Phys. **81**, 435810203 (2015) [selected by the Editorial Board of the JPP as one of first 20 "Featured Articles"]

- H. Sugama, "*Lie Transform Perturbation Theory for Hamiltonian Systems and its Application to Guiding Center Motion*," J. Plasma Fusion Res. **91**, 51 (2015) [in Japanese] [listed in top 10 most downloaded articles of JPFR during Jan.-June 2015]

NSRP contributes to theoretical systemization of fusion plasma physics by publishing many review papers

- Methods of Fusion Plasma Simulation: Utilizing Massively- Parallel Computation [Lecture Note] [in Japanese]
  1. T. –H. Watanabe, “Introduction,” J. Plasma Fusion Res. Vol. 89, 45 (2013) [in Japanese]
  2. H. Sakagami, “Elementary Technique to Develop Parallelized Codes,” J. Plasma Fusion Res. Vol. 89, 49 (2013) [in Japanese]
  3. H. Miura, Y. Todo, and T. Gotoh, “Coding Techniques of MHD Simulations,” J. Plasma Fusion Res. Vol. 89, 119 (2013) [in Japanese] [most downloaded article of JPFR in Feb. 2013]
  4. T. –H. Watanabe and Y. Idomura, “Coding Techniques for Vlasov Simulations,” J. Plasma Fusion Res. Vol. 89, 171 (2013) [in Japanese]
  5. H. Naitou and S. Satake, “Coding Techniques of Particle Simulations,” J. Plasma Fusion Res. Vol. 89, 245 (2013) [in Japanese]



- A. Ishizawa, “Hydrodynamic Instabilities and Mix Studies on National Ignition Facility,” J. Plasma Fusion Res. Vol. 90, 228 (2014)[Commentary][in Japanese]

- S. Ishiguro and H. Ohtani, “Experience the Fusion Plasma : To Experience is to Believe,” J. Plasma Fusion Res. Vol. 90, 325 (2014)[Commentary][in Japanese]

NSRP contributes to theoretical systemization of fusion plasma physics through publishing many review papers

- Overview and Prospect: Frontier Researches in Magnetic Reconnection

  [Special Topic Articles][in Japanese]

  1. Y. Ono, R. Matsumoto, M. Hoshino, T. Shimizu, and R. Horiuchi, “Introduction - Rapid Progress in Interdisciplinary Research of Magnetic Reconnection,” J. Plasma Fusion Res. Vol. 89, 753 (2013) [in Japanese]

  2. Recent Researches on Fast Magnetic Reconnection Mechanism

  2.1 R. Horiuchi, “Dissipation of Current Sheet,” J. Plasma Fusion Res. Vol. 89, 759 (2013) [in Japanese]

  5. Problems and Future of Reconnection Research

  5.1 S. Usami and S. Zenitani, “Problems and Future of Simulation Studies” J. Plasma Fusion Res. Vol. 89, 861 (2013) [in Japanese]

  6. Y. Ono, R. Matsumoto, M. Hoshino, T. Shimizu, and R. Horiuchi, “Summary: Present and Future of Magnetic Reconnection Research,” J. Plasma Fusion Res. Vol. 89, 880 (2013) [in Japanese]

Summary of research achievements in Micro Physics and Modeling

- Enhancements of core heating have been achieved using targets for energetic ion assisted fast ignition in inertial fusion.
- The self-consistent micro structures in a plasma blob in SOL have been revealed with PIC simulations.
- The influence of macroscopic dynamics on microscopic physics of reconnection has been revealed with MARIS code.
- Particle simulation has revealed the interaction of electrons and ions accelerated by a collisionless shock wave.
- Gyrokinetic simulation including a new zonal-flow closure model reproduces results of gyrokinetic ITG turbulent transport simulation.
- Gyrokinetic field theory is extended to include effects of collisions and time-dependent background magnetic fields.
- Modeling of heat diffusivity has been done for dynamical transport simulation.
- A kinetic Monte-Carlo (kMC) code was developed to calculate the diffusion process of He in tungsten in atomic level

3. Promotion of cooperation and collaborations

(1) Does the NSRP promote collaboration research as the center of excellence by integrating the high capabilities of universities and institutes?
(2) Does the NSRP contribute to the development of research in universities? Does the NSRP function as a research hub for the dissemination of academic information to other fields?
(3) Does the NSRP promote international cooperation through contributions to ITER, BA activities, and other international collaborations?

NSRP promotes collaboration research as a Center of Excellence (COE) by integrating the high capabilities of universities and institutes such as those listed below.

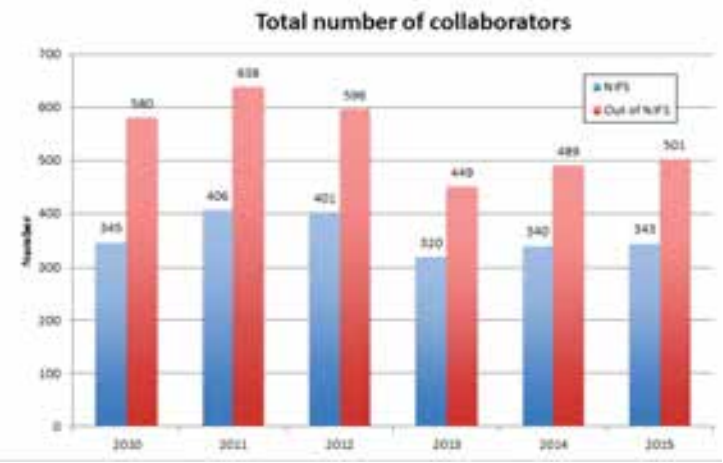
① NSRP cooperation program has accepted more than 100 research subjects.
② The Plasma Simulator Symposium provides collaborators with opportunities for the exchange of research information.
③ Collaborators from universities and institutes have joined the NSRP task groups.

Framework of the general collaboration research programs at NIFS relating to NSRP

Three categories in NIFS collaboration programs regarding to theory and numerical simulation

1. Theory collaboration research
   - Programs proposed by NIFS
   - Programs proposed by domestic collaborators
2. Plasma Simulator collaboration research
   - Programs proposed by NIFS
   - Programs proposed by domestic collaborators
3. Collaboration research utilizing the LHD Numerical Analysis Server

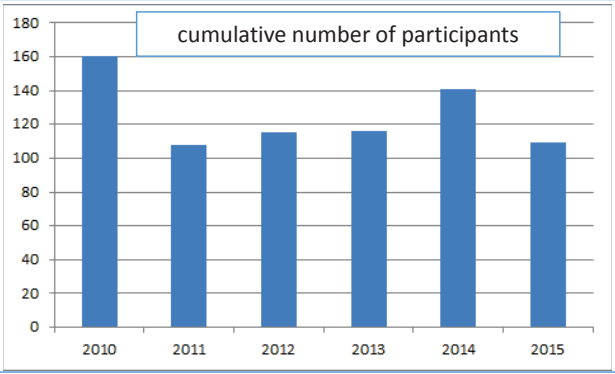
NSRP collaboration program has accepted more than 100 research subjects



- The number of accepted collaboration subjects is approximately 120.
- The total number of collaborators in the accepted subjects is approximately 1,000 each year, including 400 from NIFS and 500 from universities.

The Plasma Simulator Symposium provides collaborators with opportunities for the exchange of research information

- The Plasma Simulator Symposium (Simulation Science Symposium) has been held for the Plasma Simulator users to report recent numerical results and also to introduce to the users recent topics in large-scale numerical simulations in various fields.



- Recent numerical results obtained by utilizing the Plasma Simulator are reported.
- Recent activities of large-scale numerical simulations in various fields are introduced to the users.
- Various subjects associated with plasma theory and large-scale numerical simulations, such as those related to the HPCI; IFERC-CSC (ITER-BA), and the JIFT are discussed at the Symposium.

HPCI: High Performance Computational Infrastructure; IFREC-CSC: International Fusion Energy Research Centre – Computational Simulation Centre; JIFT: Joint Institute for Fusion Theory

Many collaborators from universities and institutes join the NSRP task groups

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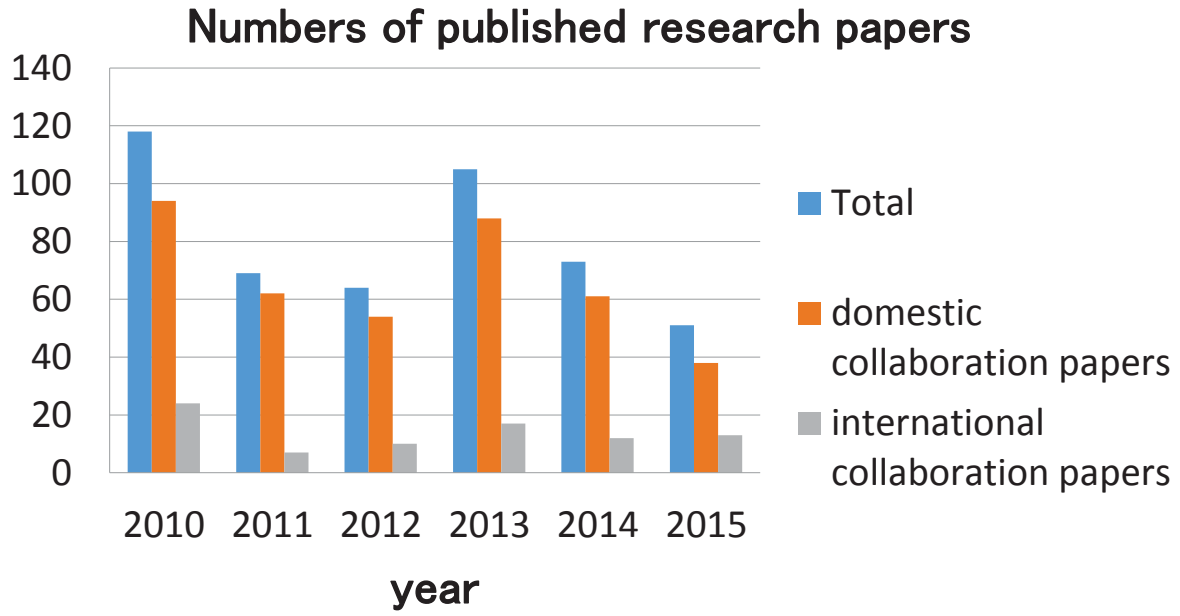
group	leader	member
Plasma fluid equilibrium stability	K. Ichiguchi	14（sim. 9, exp. 3, collab. 2）
Energetic-particle physics	Y. Todo	5（sim. 2, exp. 2, collab. 1）
Integrated transport simulation	M. Yokoyama	21（sim. 4, exp. 13, collab. 4）
Neoclassical and turbulent transport simulaton	R. Kanno	14（sim. 9, exp. 1, collab. 4）
Peripheral plasma transport	Y. Suzuki	9（sim. 4, exp. 5）
Plasma-wall interaction	H. Nakamura	18（sim. 4, exp. 3, collab. 11）
Multi-hierarchy physics	H. Miura	18（sim. 12, collab. 6）
Simulation science basis	H. Ohtani	16（sim. 12, exp. 1, collab. 3）

480 research papers relating to the NSRP have been produced through many domestic and international collaborations from 2010 to 2015



- Among 480 research papers are 397 domestic collaboration papers and 83 international collaboration papers.

3. Promotion of cooperation and collaborations

(2) Does the NSRP contribute to the development of research in universities? Does the NSRP function as a research hub for the dissemination of academic information to other fields?

A) The NSRP plays a central role in collaborations with universities. ➔ list of universities and topics in next page

B) The NSRP plays a central role in exploring new interdisciplinary fields by organizing symposia and promoting collaborations under NINS cooperation programs listed below.

A) NSRP plays a central role in collaborations with universities

A) Nagoya University
- First application of EMC3-Eirene code to modeling of linear divertor plasma simulator experiments with 3D effect

B) Nagoya Institute of Technology
- Collaboration with NIT contributes to code development as well as education

C) Kyoto University
- Transport issues in helical plasmas (TASK/WM, TASK3D, and others)

D) Kyoto Institute of Technology
- Simulation on helical states in RFP

E) Kyusyu University
- Global nonlinear simulation and numerical diagnostics of turbulent dynamics
- Study of turbulence interacting with shear flow

F) Gunma University
- Resistive MHD and hybrid simulations of high-beta self-organized plasmas

G) Saitama University
- Tungsten material with nano-structure

H) Yamagata University
- Analysis of a thin film made of high-temperature superconducting material

I) Tokyo University of Technology
- Electromagnetic Wave Propagation Simulation in Corrugated Waveguide and Miter Bend by FDTD

J) National Institute of Technology, Kushiro College
- MD simulation for forming amorphous carbon film

EMC3-EIRENE modeling of a linear device with 3D target-plate geometries has been made

- Plasma of the NAGDIS-II device has been modeled by the EMC3-EIRENE code under the **collaboration between Nagoya University and NIFS**.
- Different target-plate geometries were simulated.

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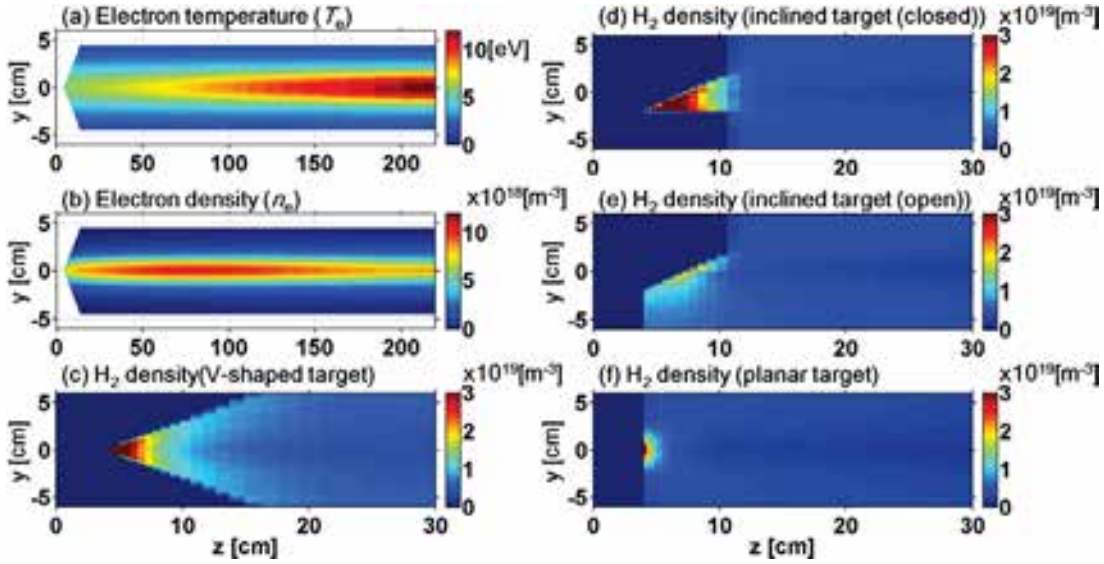


[T. Kuwabara et al., submitted to Contrib. Plasma Phys.]

- The H_2 molecular is strongly accumulated at the tip of the V-shaped and the inclined target plate (closed structure) in comparison with the planar target plate.
- The shape of the target plate influences the recycling near the target plate.

Collaboration with NIT contributes to code development as well as education

- Based on the agreement on the collaboration between NIFS and Nagoya Institute of Technology (NIT) in July 2009, collaboration research and activities are promoted.

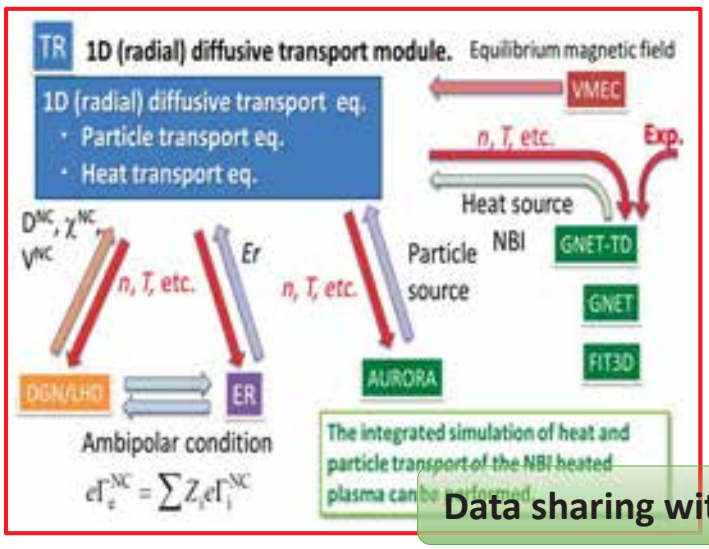
NIFS-NIT joint seminar

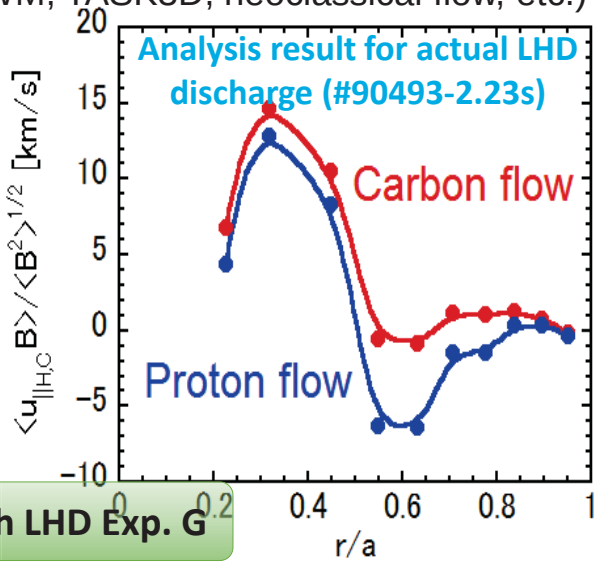
- The 4th joint seminar, July 29, 2011, held at NIFS
- The 5th joint seminar, Feb. 13, 2012, held at NIFS
- The 6th joint seminar, Set. 24, 2012, held at NIFS
- The 7th joint seminar, Oct. 11, 2013, held at NIT
- The 8th joint seminar, Dec. 15, 2014, held at NIT (Tajimi, near NIFS Toki site)
- The 9th joint seminar, Dec. 10, 2015, to be held at NIT

- A simulation technique for spectral compact hybrid simulation has been developed.
- A NIT student was educated under the special joint-use system.
- NIFS staff educates NIT students for numerical simulations through an internship program on numerical simulations in NIFS as well as a series of lectures at NIT (5-8 students each year). NIT gives students a course credit for this internship program.

Collaboration with Kyoto University

Collaboration with Kyoto University has been further strengthened mainly on transport issues in helical plasmas (TASK/WM, TASK3D, neoclassical flow, etc.)





Data sharing with LHD Exp. G

- TASK3D(-p) has been developed and applied to LHD experimental data for relevant transport modelling (high-Ti discharges with carbon pellet inj.) *(S. Murakami, H. Yamaguchi, and Prof. A. Fukuyama for instructions on WM development, Dept. of Nuclear Engineering)*
- Neoclassical ion flow analysis for multi-ion species (→ difference of parallel flow) including ambipolar Er → valuable information for the LHD experiment *(K. Nishioka, Prof. Yuji Nakamura et al., Graduate School of Energy Science)*

MIPS simulation on helical states in RFP was verified through experiments and NIMROD analysis

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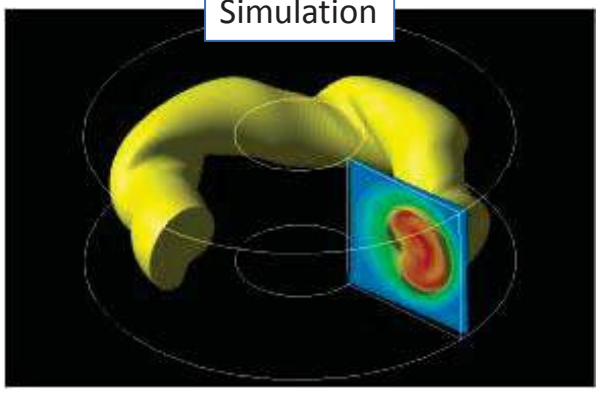
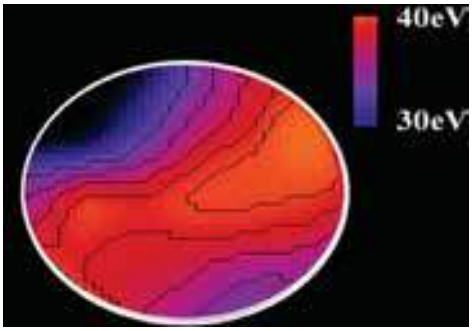
- Formation of helical structure in RFP experimental configuration was reproduced by MIPS nonlinear simulation. [**Collaboration with Kyoto Institute of Technology**]
- Results are compared with the SXR measurement in RELAX device and NIMROD simulation.

Simulation



Experiment



- The m=1/n=4 deformation is observed in both the MIPS simulation and the experiment.
- Qualitative agreements are seen between MIPS and NIMROD results. Higher mode components are dominant in the NIMROD result.

Resistive MHD and hybrid simulations of high-beta self-organized plasmas

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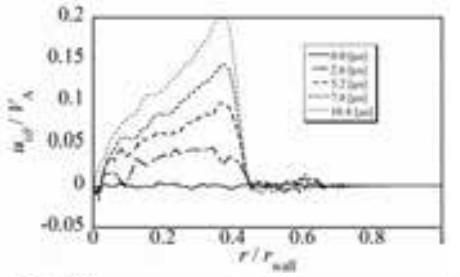
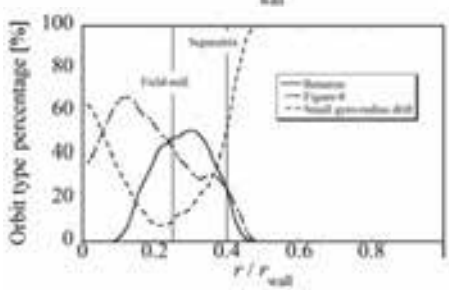
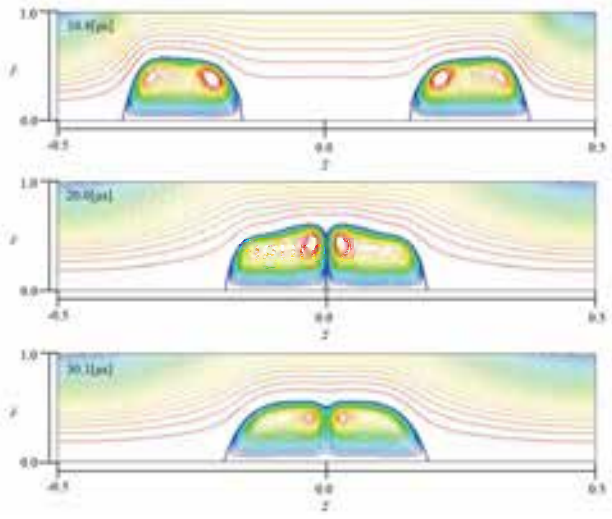
- Origin of toroidal spin-up of high-beta field-reversed configuration (FRC) is investigated by hybrid simulation.
- Axial collision of two FRCs is simulated by using a resistive MHD model.



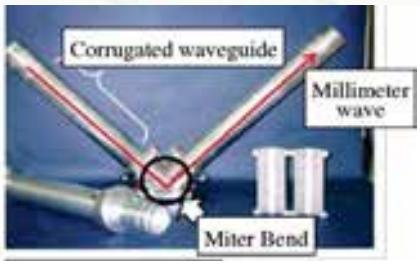


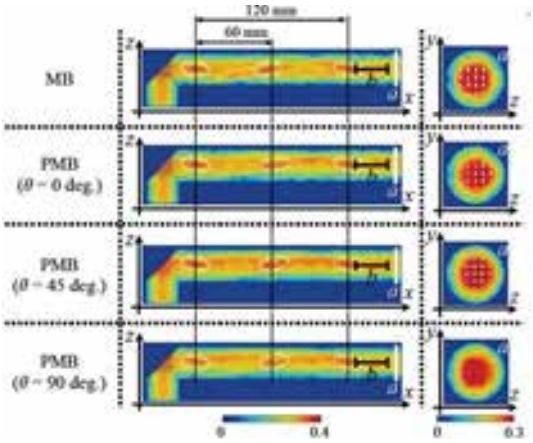


- Gradual toroidal spin-up results from acceleration of betatron particles by the toroidal inductive electric field.
- An anomalous resistivity in the reconnection region is needed to complete a merging process of two FRCs.

Finite-difference time-domain (FDTD) code was developed to analyze electromagnetic wave propagation in miter bend in the ECH system together with Tokyo University of Technology (TUT) and the ECH group in the LHD project

- We developed Finite-difference time-domain (FDTD) code with Drude model to calculate the induced current in the metal which composes the ECH waveguide system (i.e., Corrugate waveguide and Miter Bend (MB)) with TUT and ECH groups.





- Spatial distribution of time-averaged electric field intensity can be obtained by FDTD simulation.
- The high order mode is generated when the transmitting wave is reflected on MB.
- The polarization can be controlled by changing the rotation angle of MB with polarizar.

NSRP organizes several workshops for collaboration each year

List of workshops

- **2010** **8 Workshops** (SNET, Virtual Lab., Advanced reactor, Non-linear problem and visualization, MHD, Security, High-beta plasma, Mathematical model and numerical solution)
- **2011** **5 Workshops** (VR visualization, Plasma-wall Interaction, High-beta plasma, MHD, Mathematical model and numerical solution)
- **2012** **5 Workshops** (Multi-scale mathematical model and Large-scale simulation, High-beta plasma, Multi-scale MHD, VR visualization, plasma-wall interaction)
- **2013** **6 Workshops** (Frontiers of computational fluid dynamics, VR visualization, Visulization-driven analysis, Divertor heat and particle control, Stability in MHD, High-beta plasma)
- **2014** **6 Workshops** (Advanced visualization, Chemical reaction and material processing, High-beta plasma, Integrated modeling, VR visualization, Resonance and bifurcation in MHD)
- **2015** **5 Workshops** (Modeling of impurity transport, Particles in fluid, High-beta plasma, VR visualization, Integrated modeling)

The NSRP plays a central role in exploring new interdisciplinary fields by organizing symposia and promoting collaborations under NINS cooperation programs listed below.

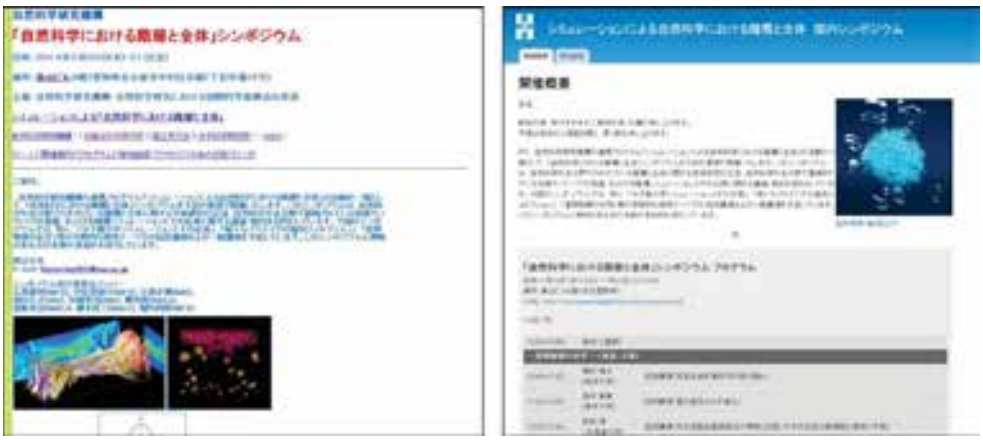
The National Institutes of Natural Sciences (NINS) consists of **five inter-university research institutes in Japan**: National Astronomical Observatory of Japan (NAOJ), National Institute for Fusion Science (NIFS), National Institute for Basic Biology (NIBB), National Institute for Physiological Sciences (NIPS), and Institute for Molecular Science (IMS).

A) Hierarchy and Holism in Natural Science [2004-2015]
B) Science for Controlling Temperature in Non-equilibrium State [2010~2012]
C) Development of Data Compression Scheme on Scientific Visualization for Simulation Data of Huge Particle System [2012]
D) Magnetic Reconnection Studies with Kinetic Simulations [2012]
E) NINS Program for Cross-Disciplinary Study for tungsten nano-structure formation [2011-2013]
F) Study of the relation between a high dimensional neuronal activity and connections of local neural circuits in an active brain [2014-2015]
G) Research on turbulences, magnetic islands, and magnetic field lines in magnetically confined plasmas [2010-2015]

The program "Hierarchy and Holism in Natural Sciences" contributes to establishing a research hub for multi-hierarchy simulation in natural systems

skip

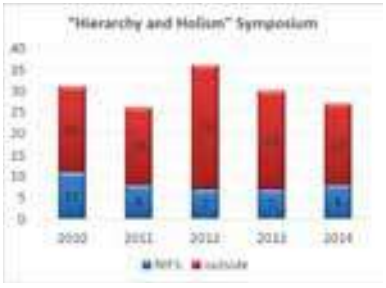
- The main activities are (1) Organization of symposia and workshops to explore new interdisciplinary fields among astrophysical, plasma, and molecular sciences, (2) Development of new simulation models, and (3) Application of models to natural phenomena with hierarchical structure.

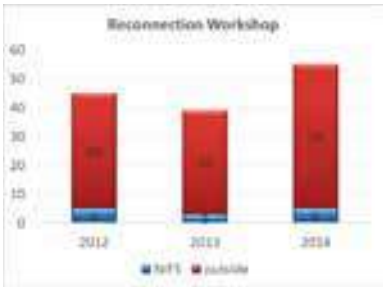


- Multi-hierarchy models based on coupling MHD and PIC are developed and applied to magnetic reconnection.
- Multi-scale simulation approach composed of MD, BC, DFT, and KMC succeeds in reproducing fuzzy nanostructure.

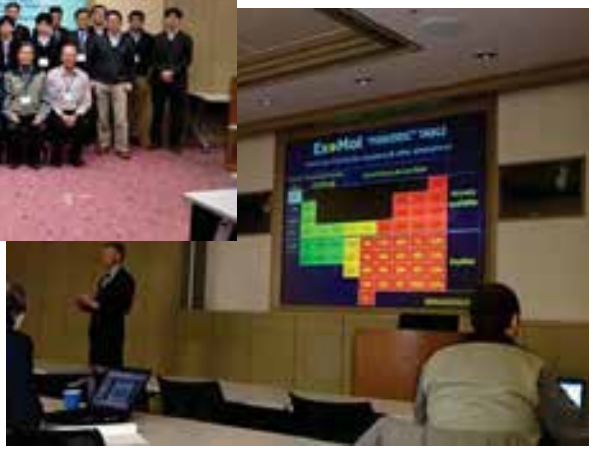
Symposia and workshops are hosted each year and many researchers attend from outside NIFS

- Symposia on “Hierarchy and Holism in Natural Sciences” and Workshops on “Magnetic Reconnection” have been hosted annually.





International symposia on “Hierarchy and Holism in Natural Sciences”, on February 2013.



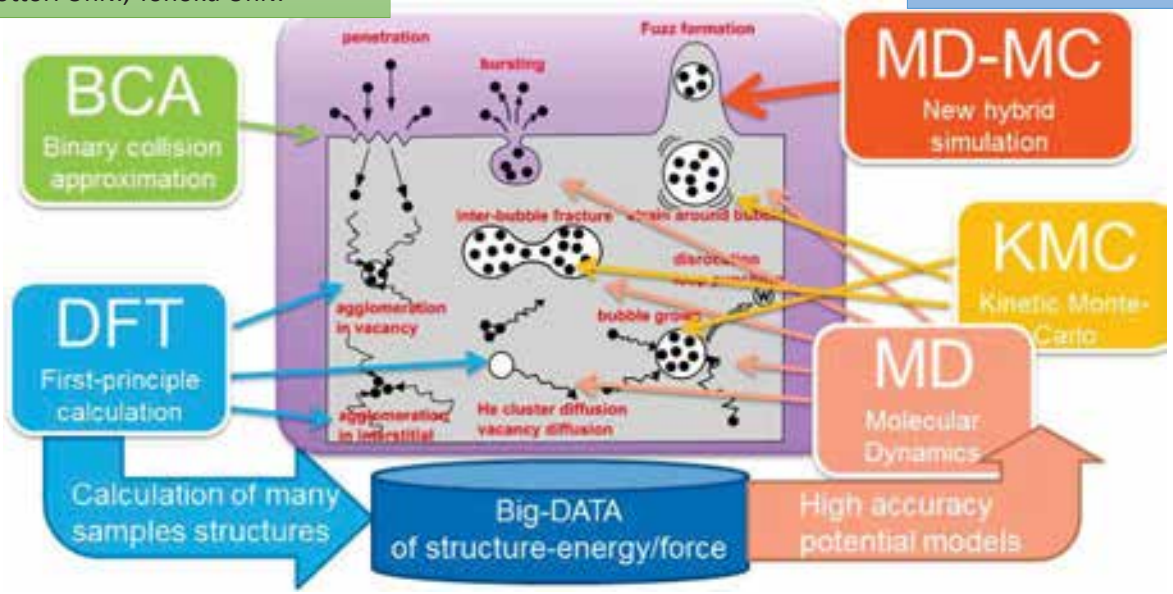
- Many researchers from outside participate in symposia and workshops to discuss interdisciplinary topics.

NINS Program for Cross-Disciplinary Study 2011-2013 for tungsten nano-structure formation

Material science
IMS, Nagoya Inst. Tech., Tottori Univ., Tohoku Univ.

Plasma-wall simulation
NIFS, Kushiro

Plasma experiments
Nagoya Univ., Aichi Inst. Tech, Shimane Univ.



- Collaboration enables use of multi-scale simulation approaches on a tungsten-helium system.
- MD-MC hybrid method and a high accuracy potential model were developed, and then fuzzy nanostructure formation was successfully simulated.

NINS cooperation program "Study of the relation between a high dimensional neuronal activity and connections of local neural circuits in an active brain" contributes to establish new methodologies for investigation into global dynamics on a cerebral cortex

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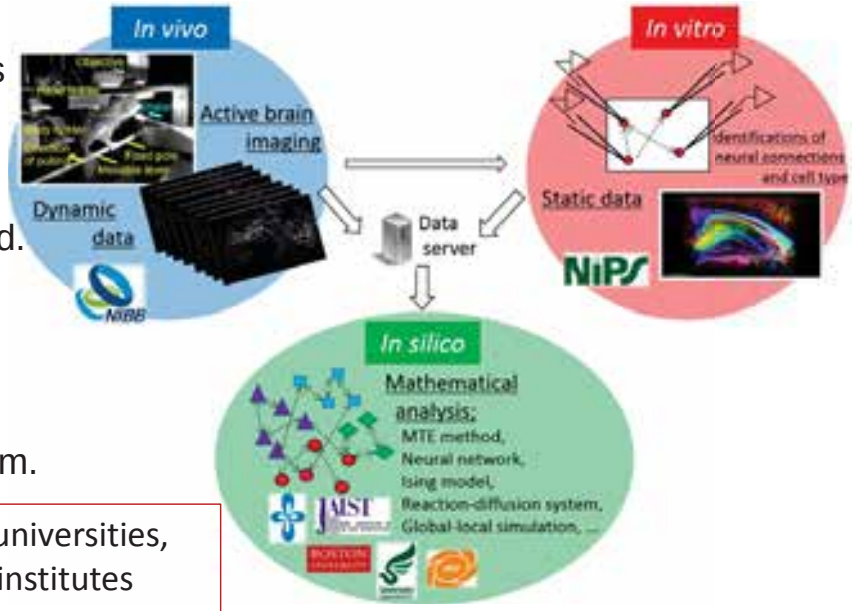
- New experimental and mathematical methodologies for investigation into global dynamics on a cerebral cortex have been established.
- Collaborations among each methodology with a cloud system have been proposed and promoted by this program.



7 collaborators from 2 domestic universities, 1 foreign university (USA), and 4 institutes (NIBB, NIPS, IMS, and NIFS).

3D VR Visualization of Plasmas enables analysis of simulation and device data in a real 3D space

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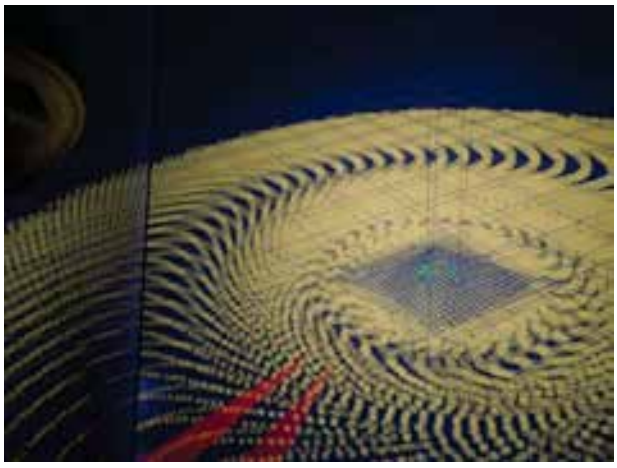
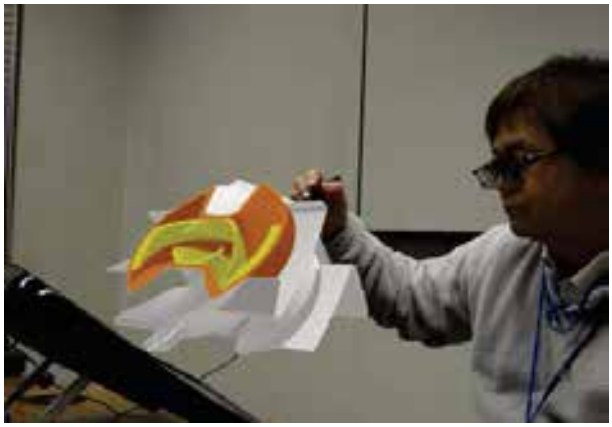
- The function of N-body visualization tool "Zindaiji3" has been expanded for the CompleXcope.
- Desktop VR system has been installed and applied to CAD data handling.





- A very large number of particles can be visualized in the CompleXcope.
- Desktop VR system enables handling of parts of a device in 3D.

3. Promotion of cooperation and collaborations

(3) Does the NSRP promote international cooperation through contributions to ITER, BA activities, and other international collaborations?

- The NSRP plays a central role in promoting US-Japan collaboration, wide-range collaborations with European institutions, A3 foresight program (Japan, China, Korea), and other international collaborations in fusion plasma simulation.
- The NSRP contributes to ITER and BA activities by promoting scientific collaborations in fusion simulation: by dispatching international committee members and administrative staff.

- The NSRP plays a central role in promoting US-Japan collaboration, wide-ranging collaborations with European institutions, A3 foresight program (Japan, China, Korea), and other international collaborations in fusion plasma simulation

- NSRP plays a major role in collaborations with the United States through Joint Institute for Fusion Theory (JIFT) activities: workshops and exchange of scientists
- NSRP promotes wide-ranging collaborations with European institutions.
- Collaborations with China and Korea are progressing under the A3 foresight program and post-CUP (Core-University-Program).

NSRP conducts collaborations with US through Joint Institute for Fusion Theory (JIFT) activities

- NSRP supports US-Japan workshops and exchange scientists to promote simulation science based on fusion plasma research.
- NSRP contributes to management of JIFT activities.

JIFT Steering Committee	
US Members	*Japanese Members*
F. Waelbroeck (IFS)—Co-Chairman A. Arefiev (IFS)—Co-Exec. Secretary D. Spong (ORNL) J. Mandrekas (DOE)	R. Horiuchi (NIFS)—Co-Chairman H. Sugama (NIFS)—Co-Exec. Secretary A. Fukuyama (Kyoto) H. Nagatomo (Osaka)
JIFT Advisor Committee	
US Members	***Japanese Members***
A. Aydemir (IFS), P. Catto (MIT), B. Carreras (BACV Solutions), V. Chan (GA), B. Cohen (LLNL), W. Horton (IFS), W. Tang (PPPL), and P. Terry (UWM)	N. Nakajima (NIFS), S. Ishiguro (NIFS), Y. Kishimoto (Kyoto), Z. Yoshida (Tokyo), H. Naito (Yamaguchi), M. Yagi (JAEA), and T. Ozeki (JAEA)

NSRP actively conducted JIFT workshops and exchange scientists in 2010-2015

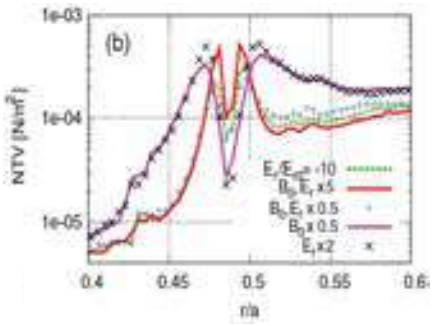
Year	Workshops	Exchange visitors	
		From NIFS	To NIFS
2010	**Laser Plasmas** by H. Sakagami (NIFS) and R. Town (LLNL) at Illinoi **Simulation Methods** by A. Arefiev (IFS) and H. Ohtani (NIFS) at Chicago	T.-H. Watanabe / PPPL Y. Todo / IFS K. Ichiguchi / BACV	C. Kim (Washington) B. Breizman (IFS)
2011	**Simulation Methods** by H. Ohtani (NIFS) and A. Arefiev (IFS) at NIFS **Turbulent Transport** by W. Wang (PPPL) and T.-H. Watanabe (NIFS) at Long Branch	A. Ishizawa / IFS S. Usami / IFS A. Ito / MIT	V. Decyk (UCLA) W. Horton (IFS) B. Breizman (IFS)
2012	**Turbulent Transport** by T.-H. Watanabe (NIFS) and W. Wang (PPPL) at Kyoto **Simulation Methods** by A. Arefiev (IFS) and H. Ohtani (NIFS) at Providence	H. Ohtani / IFS M. Nunami / PPPL	W. Horton (IFS) P. Zhu (Wisconsin) A. Kuley (UCI) D. Spong (ORNL) C. Hegna (Wisconsin)
2013	**3D Physics in Plasmas** by M.Yokoyama (NIFS) and C.Hegna (Wisconsin) at Madison **Extended MHD** by H. Miura (NIFS) and L.E. Sugiyama (MIT) at Denver **Simulation Methods** by H. Ohtani (NIFS) and A. Arefiev (IFS) at NIFS	M. Nunami / IFS S. Satake / PPPL & Wisconsin H. Hasegawa / UCSD A. Ito / MIT	F. Waelbroeck (IFS) D. Spong (ORNL) C.S. Chang (PPPL)
2014	**3D Physics in Plasmas** by M. Yokoyama (NIFS) and C. Hegna (Wisconsin) at Kyoto **Extended MHD** by H. Miura (NIFS) and L.E. Sugiyama (MIT) at Kyoto **Simulation Methods** by H. Ohtani (NIFS) and A. Arefiev (IFS) at New Orleans	H. Miura / IFS H. Sakagami / Nevada	A.Y. Pankin (Tech-X Corp) L. Zhen (IFS) D. Spong (ORNL)
2015	**3D Physics** by Y. Suzuki (NIFS) and E.J. Strait (GA) at San Diego **Extended MHD** by H. Miura (NIFS) and L.E. Sugiyama (MIT) at Golden	M. Yokoyama / PPPL M. Sato / IFS	S.R. Hudson (PPPL) D. del-Castillo (ORNL) Z. Lin (UCI) N. Ferraro (GA)

skip

NSRP produces fruitful results from collaborations with US in 2013-2015

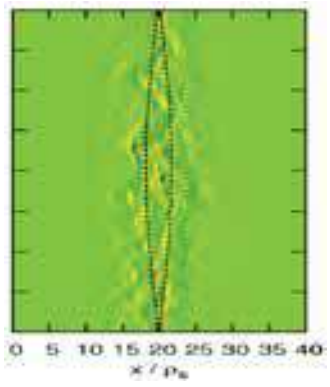
- Many collaboration papers (PRL, NF, PoP, etc)
- Many international presentations (IAEA-FEC, APS-DPP, Sherwood, etc)

- Satake, Park, et al. : *ExB effects on Neoclassical Toroidal Viscosity* NF (2013)



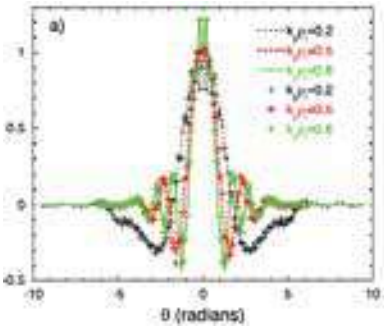
Radial profiles of neoclassical toroidal viscosity obtained by FORTEC-3D

- Ishizawa & Waelbroeck : *Magnetic islands in ITG turbulence* PoP (2013)



Ion flow vorticity around magnetic island

- Mikkelsen, Nunami, et al. : *Benchmark test of gyrokinetic codes* PoP (2014)



ITG mode potential eigenfunction obtained by GKV-X & GS2 codes using LHD configuration

Wide-ranging collaborations have been progressed with European institutions

3D equilibrium for MAST

CCFE

- 3D equilibrium
- Gyrokinetic benchmark
- NC codes benchmarking

IPP

IEA* Implementing Agreement
- Stellarator-Heliotron
- TEXTOR
- Large Tokamaks

Academic Agreements
- IPP (Germany)
- CIEMAT (Spain)
- LIA* (NIFS, Kyushu, Osaka - CNRS, U. Aix-Marseille) (France)
- U. Aix-Marseille (France)
- ITER
- RFX Consortium, IGI (Italy)
- CEA (France)

LIA*
Plasma turbulence and transport

JÜLICH

- Impurity transport in divertor
- 3D equilibrium for TEXTOR

CNRS

EPFL

Aix Marseille université

3D equilibrium

Universidad Carlos III de Madrid

MHD stability

iter

CONSORZIO RFX

Plasma turbulence

ITPA*
- Energetic particle
- Pedestal
- Integrated Modelling

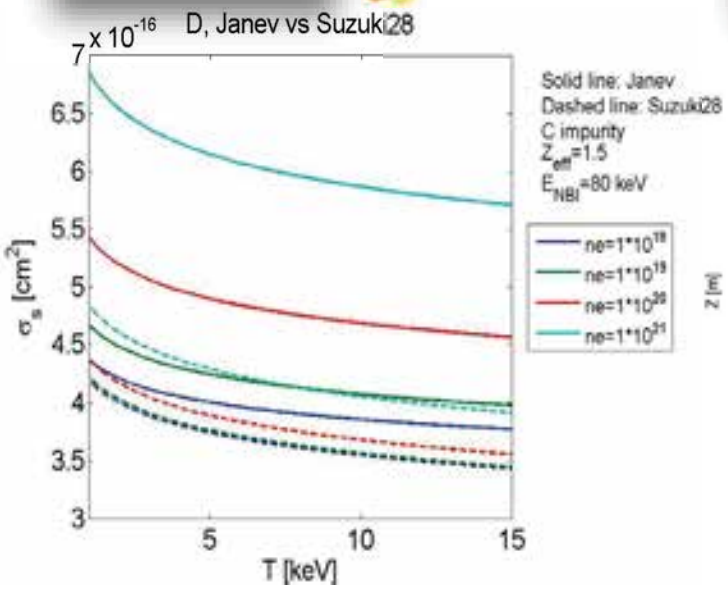
- NBI module improvement (TASK3D-a)
- 3D equilibrium and t1D transport

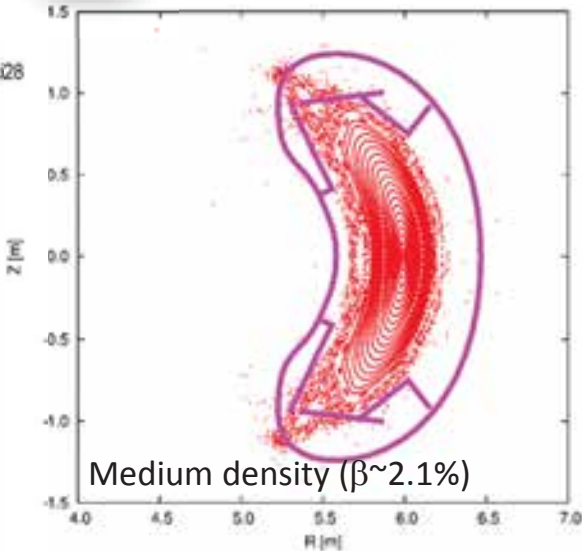
- 3D equilibrium
- NC codes benchmarking

Cutting-edge collaborations in simulation and theory have progressed based on bilateral academic agreements and IEA implementing agreements.

IEA: International Energy Agency, ITPA: International Tokamak Physics Activity, LIA: Associated International Laboratory

Highlights from collaborations with European institutions

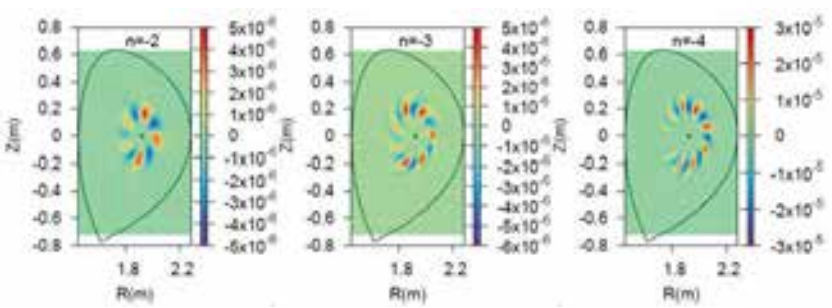




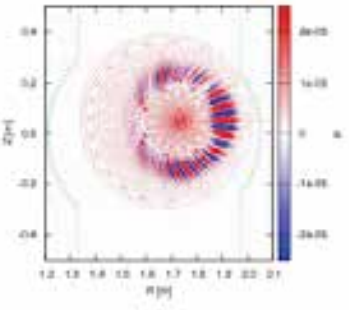
- (RFX consortium, V.Pietro - TASK3D-a) Updates of NBI modules in TASK3D-a for the upcoming LHD deuterium campaigns (EUROfusion stay, 2014 and 2015) → EPS2015, ITC25, PhD thesis
- (IPP-Greifswald, J.Geiger – Y.Suzuki: HINT2) Impact of 3D equilibrium response on edge topology and divertor heat loads in W7-X → ISHW oral

Collaborations with China and Korea in A3 Foresight Program and Post-CUP

- ASIPP
  - Energetic particle driven instabilities in EAST tokamak (collaboration with Y. J. Hu and N. Xiang)
  - Divertor plasma modeling (with G. J. Niu, Q. Xu, Z. S. Yang, G. N. Luo)
  - Magnetic field structure with RMP in EAST tokamak (with G. S. Xu)



MEGA simulation of Alfvén eigenmodes in EAST tokamak



MIPS simulation of ELM in HL-2A tokamak

- NFRI
  - EP driven instabilities in KSTAR tokamak (with T. N. Rhee, J. Y. Kim)
- SWIP
  - ELM suppression with RMP in HL-2A tokamak (with Y. Liu)

- The NSRP contributes to ITER and BA activities by promoting scientific collaborations in fusion simulation and dispatching international committee members and administrative staff.

- The Director of the NIFS Rokkasho Research Center is serving concurrently as IFERC Project Leader.
- On the supercomputer of IFERC Computer Simulation Centre, more than 10 research projects (about 30% of Japanese projects) with principal investigators from NSRP are implemented each year.
- NSPR members are undertaking collaborative research projects for JT-60SA.
- NSPR members are participating in the ITPA topical group meetings. Examples of contributions to the ITPA topical groups are 1) ELM in 3D ITER equilibrium with RMP (resonant magnetic perturbation), and 2) Alfvén eigenmodes and energetic particle transport in ITER operation scenarios.

Cooperation with ITER and BA activities at the NIFS Rokkasho Research Center

- At Rokkasho village in Aomori Prefecture, the International Fusion Energy Research Centre (IFERC) project is being implemented as well as the IFMIF/EVEDA in the framework of BA activities in order to contribute to ITER and to the early realization of DEMO.
- The IFERC project is promoting 3 sub-projects: DEMO Design and R&D Coordination Centre, Computational Simulation Centre (CSC), and ITER Remote Experimentation Centre (REC).

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NIFS Rokkasho Research Center inside of JAEA Aomori Res. & Dev. Center.

- The roles of the NIFS **Rokkasho Research Center** (RRC) are to assist NIFS and universities to cooperate with BA activities, and to prepare the environment for promoting collaborative research projects between BA activities and universities.
- For such purposes, the head of the RRC has worked as the IFERC project leader since September 2010, and the RRC was moved into the JAEA Aomori Research and Development Center in April 2012.

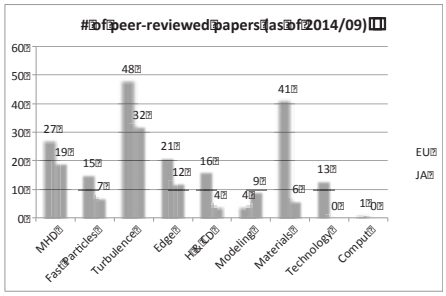
Director of NIFS Rokkasho Research Center is serving concurrently as IFERC Project Leader (PL)

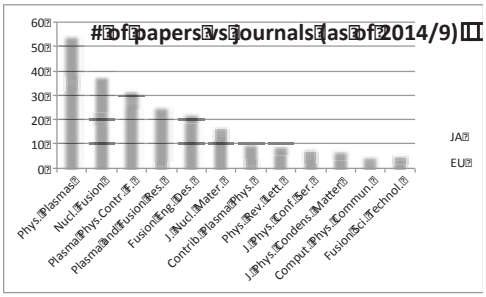
Tasks of PL

- To coordinate activities of EU and JA Implementing Agencies (IAs).
- To prepare input documents of the IFERC Project Committee (PC) for reporting activities and getting recommendation of the PC to invite the Steering Committee (SC) to approve proposals. (In spring, the main input documents are the annual report of the last calendar year and updated project plan. In autumn, those are work program of the next calendar year and summary report. Update of Value Estimates and Allocation of Contributions of the Parties is proposed just in case.)
- To hold and attend various managerial and technical coordination meetings (TCMs). (ex: Extended Project Team Meeting almost every two weeks with Fusion for Energy (F4E)).
- To assist preparation and implementation of the Procurement Arrangements.

Other recent activities as PL:

- To organize CSC review meetings with spring PCs, REC-TCMs twice per year from 2013
- To organize Joint TCMs between DEMO Design Activity and DEMO R&D Activity from 2013
- To organize DEMO review meetings with autumn PCs from 2014
- To create and analyze the database of the simulation projects by using CSC [see below]





NSRP researchers are contributing to IFERC CSC and collaborative research for JT-60SA

- NSRP members are implementing more than ten simulation projects every year on IFERC CSC HPC as principal investigators (summarized in the Table).
- One of the four Light House Projects (Jan. 2012 - Mar. 2012) was carried out by researchers from NSRP(NIFS) and JAEA using the MEGA code.
- NSRP members contribute to the committees for the IFERC CSC.
- NSRP researchers are undertaking collaborative research projects for JT-60SA.

Cycle	EU-JA allocation (80%)	JA domestic allocation (10%)
1st cycle	9 (Apr. 2012 - Nov. 2012)	2 (Apr. 2012 – March 2013)
2nd cycle	10 (Nov. 2012 - Nov. 2013)	1 (Apr. 2013 – March 2014)
3rd cycle	10 (Nov. 2013 - Nov. 2014)	3 (Apr. 2014 – March 2015)
4th cycle	10 (Dec. 2014 - Nov. 2015)	6 (Apr. 2015 – March 2016)
5th cycle	8 (Nov. 2015 – Dec. 2016)	TBD (Apr. 2016 – Dec. 2016)

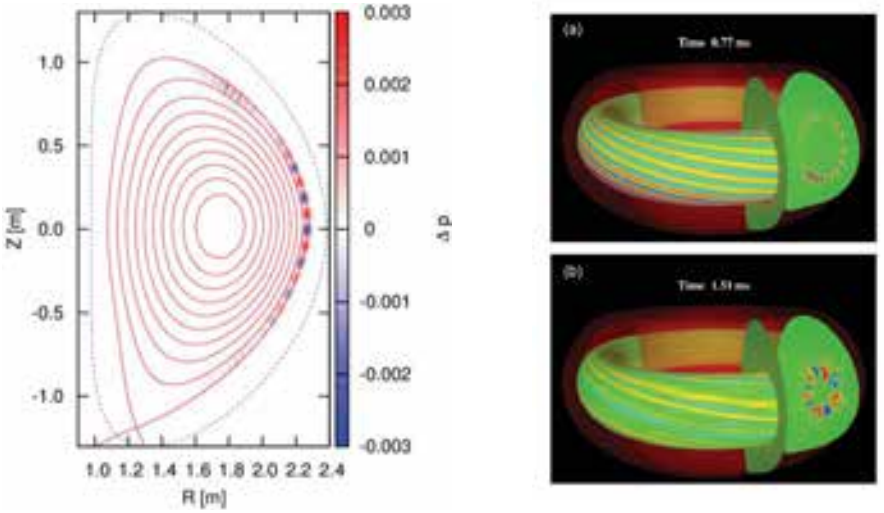
NSRP members are participating in and contributing to ITPA topical groups

- Two NSRP researchers are ITPA (International Tokamak Physics Activity) topical group members. One is a member of the Pedestal and Edge group, and the other participates in the Energetic Particles group.
- The number of participants from NSRP for each topical group meeting is summarized in the Table. The number of presentations is the same as the number of participants.

Year	Pedestal and Edge	Energetic Particles	MHD	Integrated Operation Scenarios	Transport and Confinement	Total
2009		2				2
2010	1	2	3			6
2011	1	2		1		4
2012	2	2	2			6
2013	1	2				3
2014	2					2
2015		2			1	3

ELM with RMP and energetic-particle driven instabilities were investigated for ITER

- 3D MHD equilibrium with resonant magnetic perturbation (RMP) was studied using the HINT code for ITER.
- ELM in the 3D ITER equilibria was studied with the MIPS code.
- The pedestal collapse with ELM is mitigated for the RMP equilibrium.



- Energetic-particle driven instabilities were investigated for the ITER baseline (15MA) and steady-state (9MA) scenarios using MEGA code.
- TAEs and BAEs were found to be unstable for the 9MA scenario.

4. Human resources development

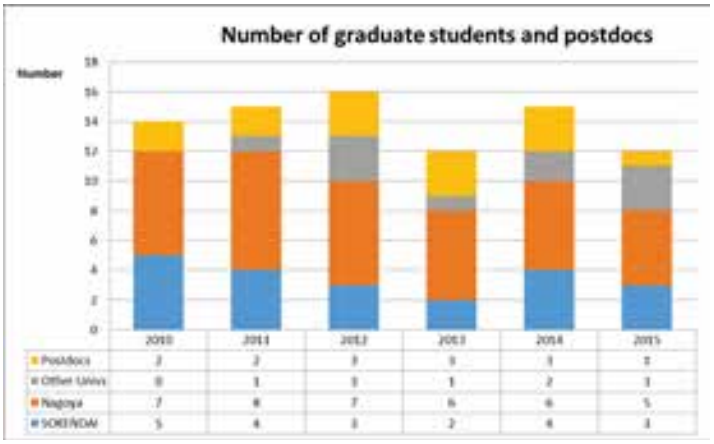
Does the NSRP contribute to the development of human resources for the international scientific workforce required for long-term fusion science through simulation research?

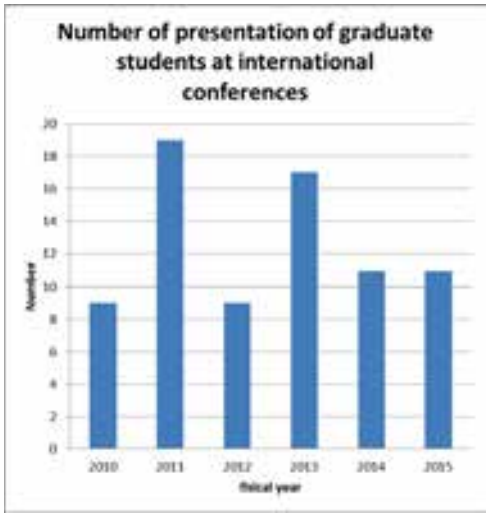
The NSRP contributes to human resources development of the international scientific workforce for long-term fusion studies through the following activities:

(1) Education programs of Sokendai and of the other graduate schools at Nagoya, Tokyo Inst. Tech., Nagoya Inst. Tech., etc
(2) Cooperation programs with high schools in science education (SSH & SPP)
(3) Sokendai Summer School
(4) Sokendai Asian Winter School and Toki Lectures on Simulation Science

NSRP contributes to the development of human resources for the international scientific workforce

- NSRP supports simulation research of 22 graduate students (from Sokendai, Nagoya Univ., Tokyo Inst. Tech., Nagoya Inst. Tech., etc.) and 4 postdocs (COE, JSPS) in 2012-2015.





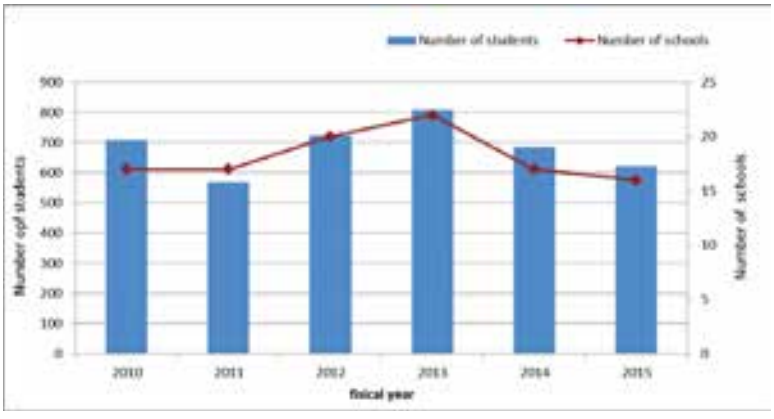
- Graduate students made 48 presentations at international conferences in 2012-2015.
- Graduate students received 6 awards in 2012-2015.

Alumni from NSRP are actively involved in the front lines of fusion simulation researches

- B. Li (PhD 2009)
  Asst. Prof., IAPCM (China)
  (2009－2011)
  Assoc. Prof., IAPCM (China)
  (2012－)
- M. Nakata (PhD 2011)
  Sokendai President's Award
  JAEA postdoc (2011－2014)
  Asst. Prof., NIFS (2015－)
- H. Wang (PhD 2012)
  SWIP (China) Asst. Prof.
  (2012－2014)
  Asst. Prof., NIFS (2015－)
- S. Matsuoka (PhD 2011)
  Post Doctoral Researcher, RIST
  (2012 －)
- S. Maeyama (PhD 2012)
  JAEA postdoc (2012－2014)
  Asst. Prof., Nagoya U. (2015－)
- S. Saito (PhD 2013)
  Asst. Prof., Kushiro College
  (2013 －)
- Y. Asahi (PhD 2015)
  Post Doctoral Researcher, JAEA
  (2015 －)

Cooperation with high schools in science education, SSH and SPP, has been promoted in collaboration with NSRP

- Cooperation programs with high schools in science education have been promoted at NIFS with the help of the "**Super Science High School" (SSH)** program and the "**Science Partnership Program"(SPP**).



- More than 500 students come to NIFS for these programs each year.
- The NSRP has contributed to three subjects in the program:

''Numerical Simulation," "Programming and Visualization," and "Virtual Reality"

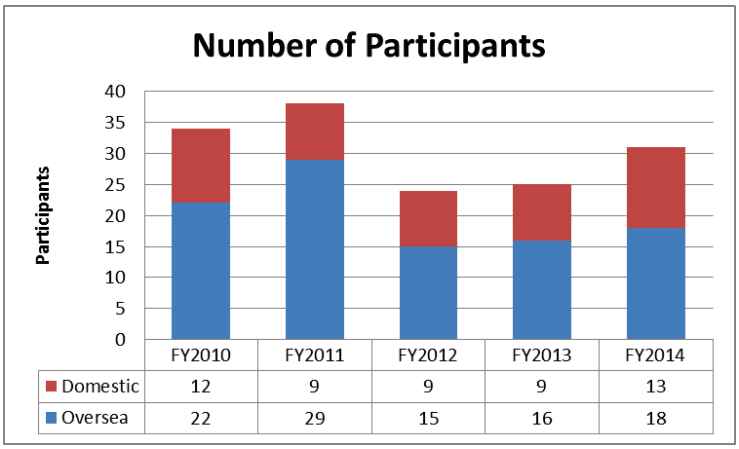
Sokendai Summer School provides graduate students with opportunities to experience the most up-to-date research at NIFS

- The purposes of this School are to gain publicity for fusion science and to look for the students who would like to become researchers in the field.

- The students experience research activities under the guidance of Sokendai teachers and students, and present their activities at the meeting.
- The NSRP staff propose three to five subjects and accept from two to four students in each subject.

Joint program of "Sokendai Asian Winter School and Toki Lectures on Simulation Science" provides students and young scientists from Asia with an opportunity to study leading-edge fusion science

- The school gives lectures on plasma physics, fusion science, simulation, experiments, LHD tour, experience of Virtual Reality, and poster presentations.



- International exchange has been promoted among foreign and Japanese participants.

5. Future Plan

Is the NSRP research plan for progressing toward the realization of the objectives appropriate? Is the research plan suitable for the next decade?

The NSRP is providing a design for a concrete approach, including a clear roadmap toward construction of the Numerical Test Reactor as the research plan suitable for the next decade. The future plan is composed of the following four research activities:

[1] Development of research systems and numerical techniques supporting large-scale simulations

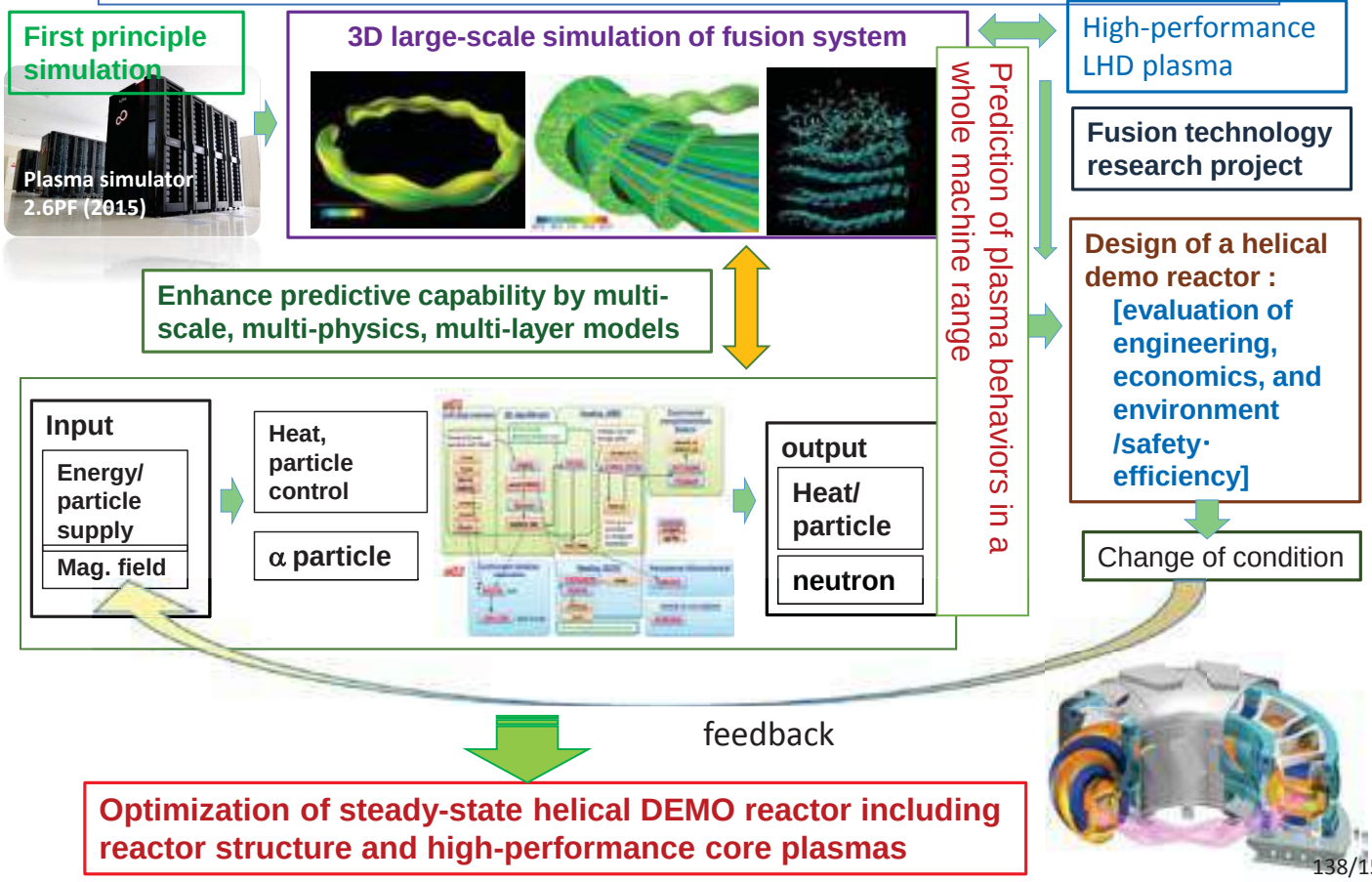
[2] Validation studies with various experimental plasmas

[3] Code improvement for burning plasmas, and verification of simulation codes through benchmarking with other codes

[4] Research toward integration of all physics elements, and design study of DEMO/FFHR

Numerical Test Reactor for a helical fusion system

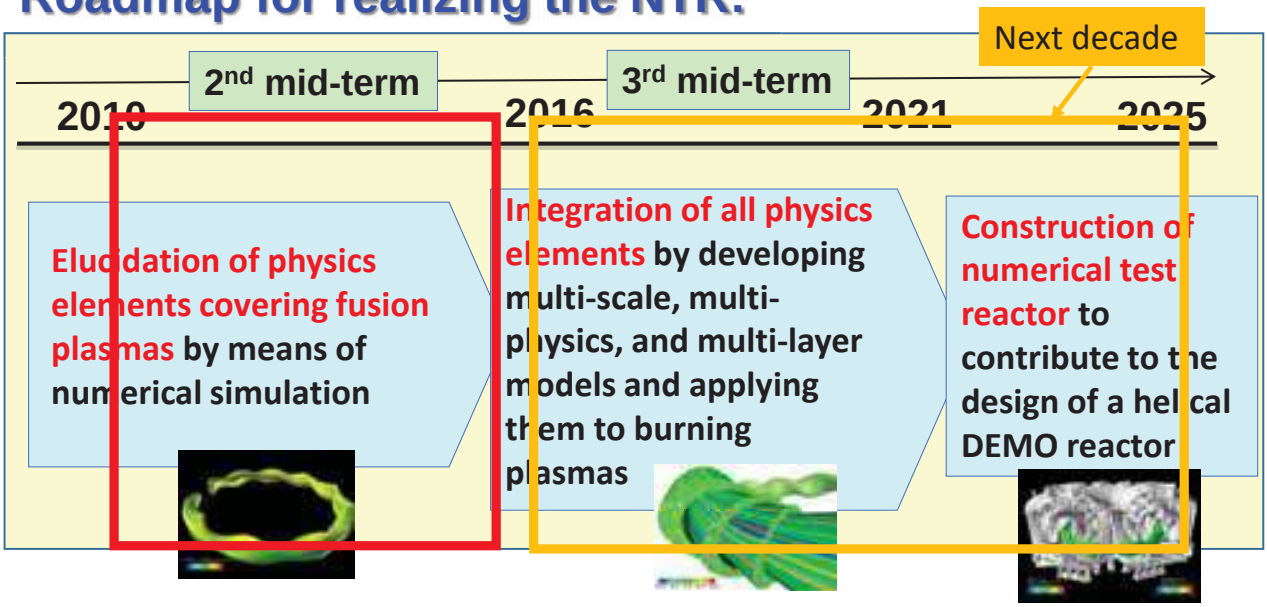
Realization of a reactor in virtual space of a supercomputer:
Optimization from physical, engineering, and economic viewpoints



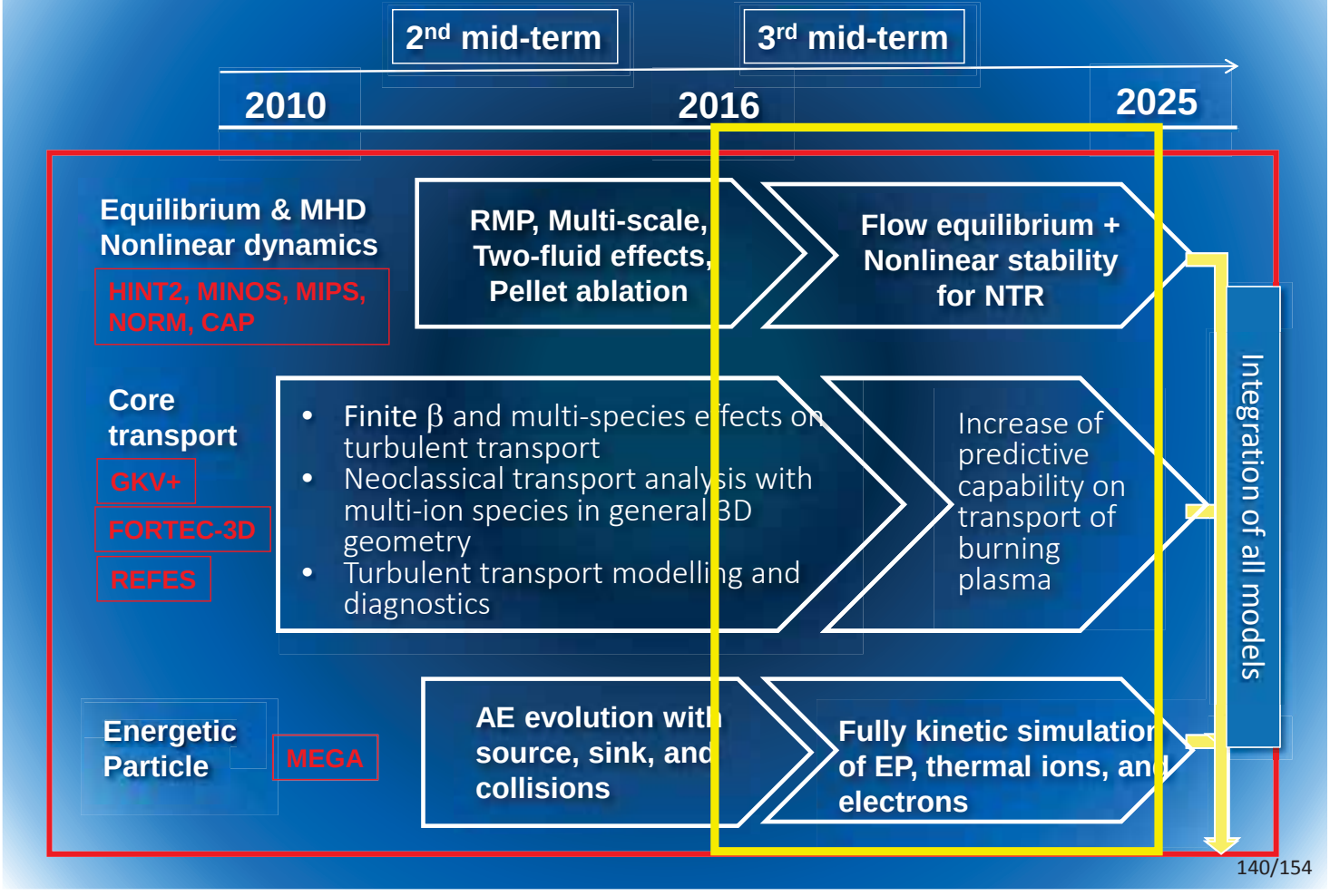
Three-step objectives of the NSRP:

1. To clarify physics elements contributing to fusion plasma confinement
2. To integrate the mechanisms individually elucidated
3. To construct the Numerical Test Reactor (NTR)

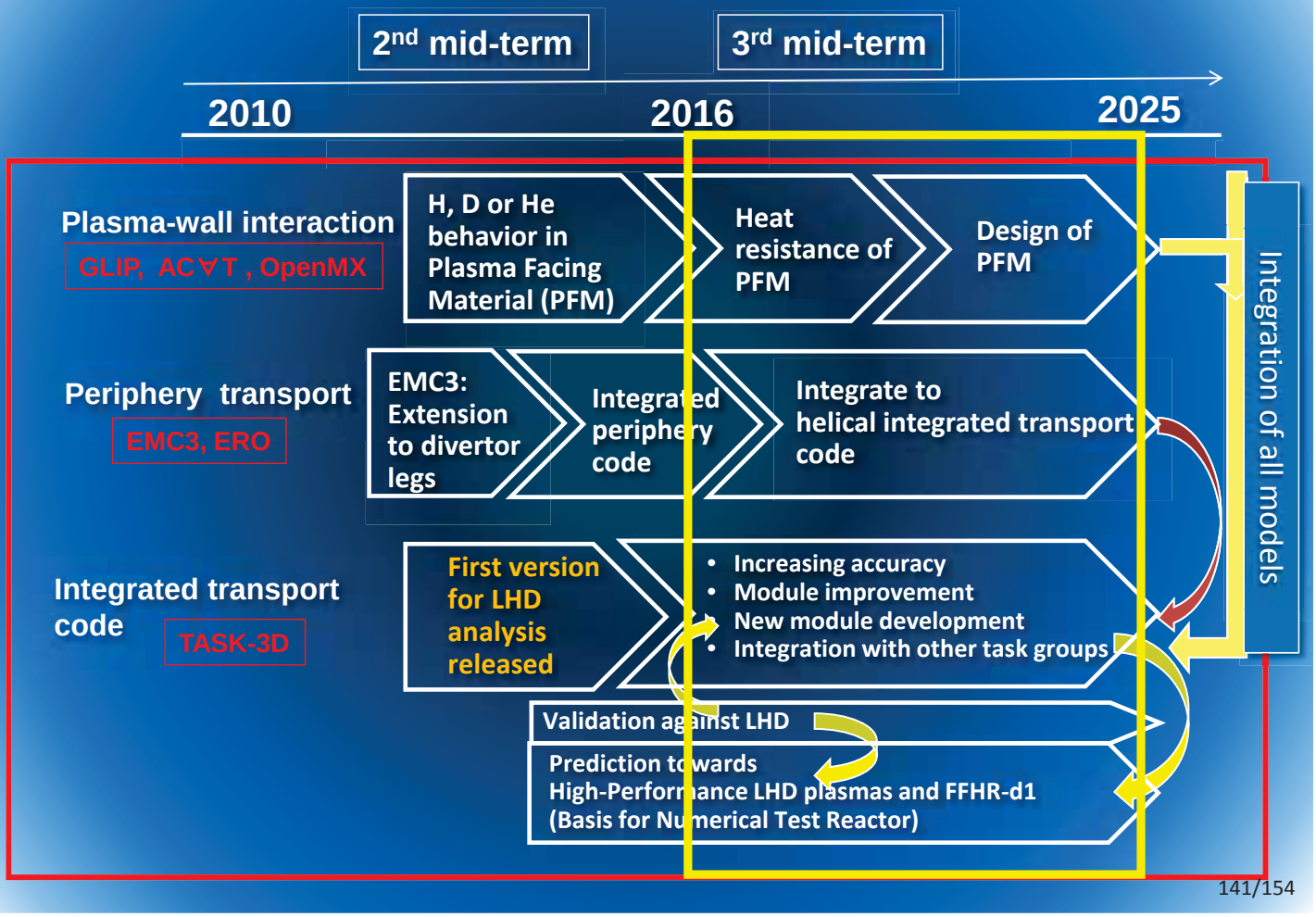
Roadmap for realizing the NTR:



Future Plan for NSRP (1)



Future Plan for NSRP (2)



Plasma Fluid Equilibrium Stability Group

Objectives :

- Further development of equilibrium code and application to 3D plasmas [2,4]
- Identification of key stability physics in LHD and quantitative prediction of stability boundary for helical DEMO [2,4]

objective	task	2013	2014	2015	2016-2020	2021-2025
				New PS	PS upgraded	
Further development of equilibrium code and application to 3D plasmas	Incorporation of flow and stochastic features in equilibrium code	Ghost surface mapping on LHD stochastic region		Incorporation of toroidal flow for tokamak equilibrium w/ and w/o RMPs	Identification of plasma edge with stochastic field lines in heliotron plasmas	
Identification of key stability physics and quantitative prediction of stability boundary for FFHR	Global mode stability simulation for LHD & FFHR	Multi-scale simulation of LHD axis swing operation	Linear eigenvalue with dissipation RMP effects on LHD pressure driven modes	Scheme development for large parallel heat conductivity	Continuous update of 3D stability database for LHD & FFHR Incorporation of diamagnetic & global shear flows	Interaction between RMP & flows (mode locking analysis)
	Extension of MHD models and comprehensive understanding of toroidal plasmas	Two-fluid effects on pressure driven modes • stab interchange and 3D ballooning modes • 4-field analysis for plasma rotation Evaluation of turbulence viscosity Mechanism of pellet plasmoid motion	Island growth due to polarization current		Development of SGS & LES model and incorporation of particle effects ELM simulation including RMP by means of gyro-fluid code Inclusion of pellet injection and atomic process	

Energetic-Particle Physics Group

Objectives :

- **Validation of MEGA code on LHD deuterium experiment [2]**
- **Improve MEGA code with kinetic bulk plasma for predictive simulation of burning plasmas [3]**
- **Port and optimize MEGA code to GPU and many core systems towards exascale computing [1]**

objective	task	2013	2014	2015	2016-2020	2021-2025
				New PS	*PS upgraded*	
Understanding of EP-driven instabilities	Simulation study of AE and GAM	**AE in ITER**		**AE with RF**		**AE in ITER with kinetic bulk plasma**
		EGAM in 2D equilibrium		**EGAM in 3D equilibrium**		
Validation and verification	Comparison with experiment, theory, and other codes	**Validation on DIII-D experiment**			**Validation on LHD deuterium experiment**	
Code development	Development of MEGA and/or kinetic codes	**NBI deposition profile**	**extended MHD model**	**ICRF fast ions**	**kinetic effects of bulk plasma**	
				optimization to new PS	**porting and optimization to GPU and many core**	

Neoclassical and Turbulent Transport Simulation Group (I)

Objectives :

- **Development of neoclassical transport simulation codes FORTEC-3D/KEATS for quantitative prediction of neoclassical transport (radial particle/heat fluxes, bootstrap current, neoclassical viscosity) in general 3D configurations [3, 4]**
- **Application of the codes for transport analysis in LHD and many other devices [2]**

objective	task	2013	2014	2015 (*New PS*)	2016-2020 (*PS upgraded*)	2021-2025
					LHD deuterium experiment	
Study on neoclassical transport (NCT) phenomena	Prediction / experiment data analysis with neoclassical transport simulation in 3D magnetic configuration	◆ Verification and Validation of NCT codes • Benchmark among local VS non-local codes to study the non-local effects in NCT phenomena • Validation with experimental measurements in LHD, TJ-II, W7-AS, HSX ◆ Effect of neoclassical viscosity on plasma rotation • Combined simulation of VMEC+TOPICS+ FORTEC-3D to study the NTV effect from toroidal ripples on toroidal rotation in JT-60U • Analysis of LHD biasing experiment (NPV) ◆ Prediction of total heat/particle transport in LHD • FORTEC-3D(NCT)+GKV(GK) ◆ Neoclassical transport of electrons and ions in tokamak plasmas affected by RMPs			◆ Isotope effect in NCT in DD/DT plasma ◆ Impurity hole/screening in LHD ◆ NTC with external magnetic perturbation in LHD and tokamaks ◆ Bootstrap current in FFHR/W7-X high-β plasma ◆ Further application of FORTEC-3D + GKV + TASK3D for transport analysis of experiment data	◆ NCT simulation study including high-energy particles / external torque ◆ Application for FFHR/ITER burning plasma operation prediction
Development of neoclassical transport codes	More precise, fast, and quantitatively reliable prediction of NCT phenomena	◆ Development of global NCT codes FORTEC-3D/KEATS • Neoclassical ambipolar-Er • Neoclassical toroidal/poloidal viscosity ◆ Introduction of source/sink term for steady state solution ◆ Control-Variate method to reduce noise ◆ Development of radially-local approx. version (zero-orbit-width model keeping tangential magnetic drift) ◆ Development of Monte-Carlo collision operator for multiple-ion plasmas			◆ Develop multi-ion-species version of FORTEC-3D/KEATS (global/local) ◆ Benchmark of local multi-ion version with DKES/PENTA ◆ Include the external momentum / heat source from ECH/NBI	◆ Integration of local FORTEC-3D with TASK3D ◆ Open-source FORTEC-3D for international collaboration

Neoclassical and Turbulent Transport Simulation Group (II)

Objectives :

- **Further development of GKV for LHD-DD and ITER burning plasma experiments [1,3]**
- **Clarification and validation of multi-species/electromagnetic turbulent transport [2,3]**
- **Further extension of reduced transport model and applying to DEMO/FFHR [1,4]**

New PS *PS upgraded*

objective	task	2013	2014	2015	2016-2020	2021-2025
Multi-species electromagnetic gyrokinetic Vlasov simulation code, GKV and associated tools	Turbulent transport simulation analyses in tokamak and helical systems	ITG & ZF analyses in JT60SA ● PFR GK-based transport model for Task3D-p ● POP Comparison of delta-f and full-f model ● NF	Validations on JT60U L-mode EXP. ● NF Impurity effects on the ITG-TEM modes in JT60U ● NF KBM simulation in helical plasmas ● POP Validations on LHD EXP. ● NF Review of EM turbulence simulations ● JPP		Fuel ions and impurity transport in ITER ● NF Isotope effects on transport in LHD plasmas ● PRL Formation of impurity hole in LHD plasmas ● PRL Saturation of high-β helical plasmas ● NF	Profile predictions with integrated transport simulations coupled with GKV ● NF EM turbulence simulations coupled with neoclassical physics ● NF
	Further extension of simulation model	Development of tokamak equilibrium interface ● PFR Dev. of kinetic electrons ● CPC	Development of multi-species collision model ● CPC ● PFR		Implementation of mean-flow and global effects ● POP Extension of reduced transport model ● POP	Optimization for EXA system ● CPC Development of Gyrofluid model for helical plasma ● POP
	Research collaborations		Validation and prediction for JT60U/SA JAEA Development of turbulence diagnostic simulator Kyushu-U		Transport solver coupled with GKV JAEA Benchmark and comparisons with other stellarators (W7X, TJ-II, HSX, etc.) IPP, Ciemat, PPPL, etc	Validation of burning plasma turbulence simulation Culham

Enable quantitative comparisons with Tokamak EXP.

Confirm prediction capability & Build up multi-species turbulence simulations for burning plasmas

Enable validations with LHD-DD EXP. & Evaluation of confinement performance for ITER

Realize V&V of burning plasma simulations in ITER & Contribution to DEMO/FFHR design

Peripheral Plasma Transport Group

Objectives :

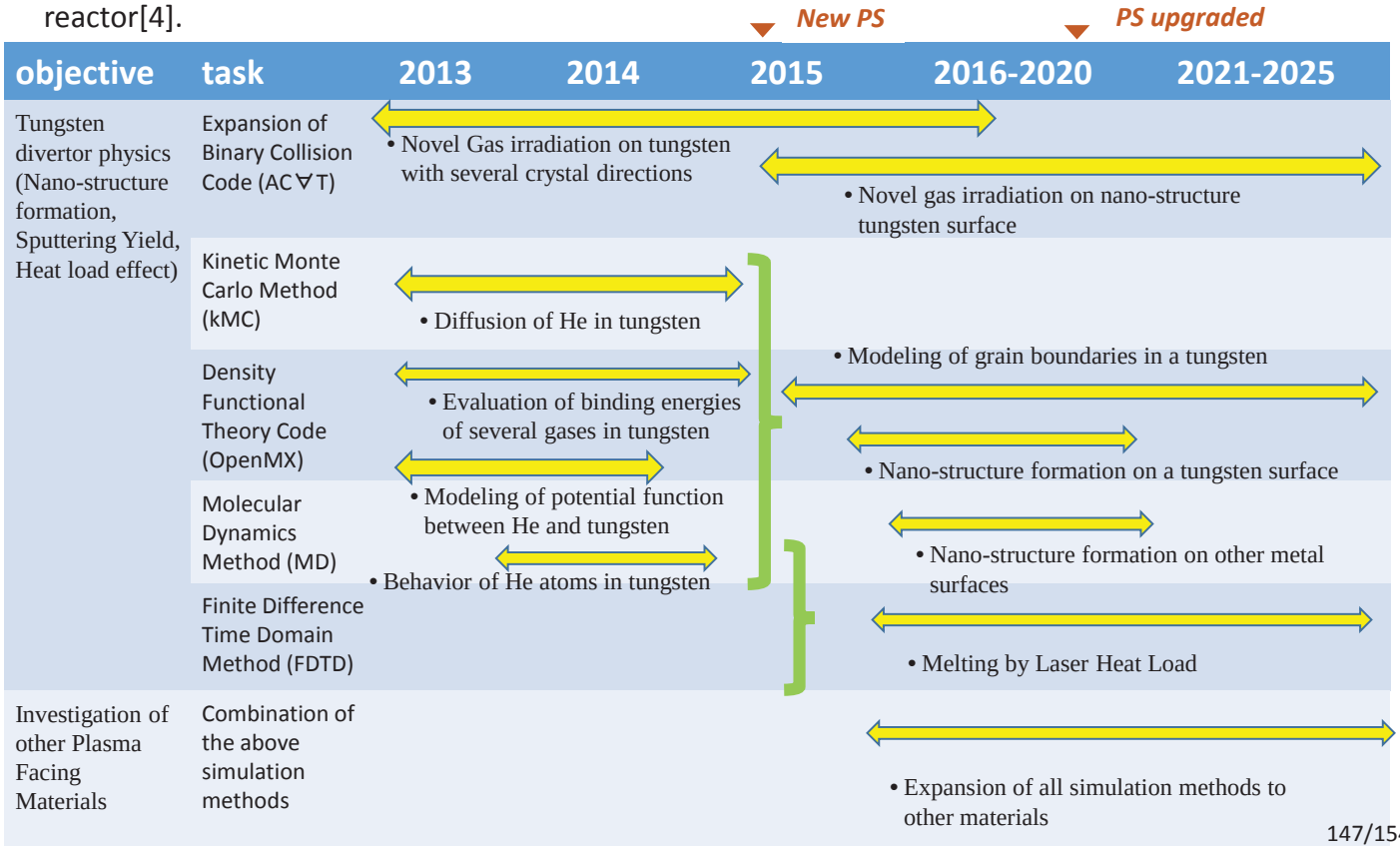
- Three-dimensional transport analysis of edge plasma in LHD [2,4]
- Modeling study on edge plasma physics, core/edge coupling, and plasma-wall interaction [1,3]

objective	task	2013	2014	2015 *New PS*	2016-2020 *PS upgraded*	2021-2025
Transport analysis of particle and energy	Validation with experiment; Development of 3D edge transport code	**neutral transport** **particle balance (pumping and fueling)**		**spectroscopy and bolometer** **improved grid development**	**Validation with LHD exp.** **global impurity transport code**	**coupling of core and edge transports** **coupling of edge transport and impurity codes**
Divertor modeling / plasma-wall interaction / dust dynamics	Collaborations with other groups/institutes	**dust simulation** **C redeposition** **PIC simulation for PWI** **NAGDIS-II modeling**			**Model improvement base on collaborations of EMC3-EIRENE / PICS / ERO / IMPGYRO / etc.**	
Predictive simulation and optimized divertor design for FFHR	Transport model development				**model development** **Particle and energy transport**	**optimization of divertor design**

Plasma-Wall Interaction Group

Objectives :

- Divertor material physics; analysis of atomic level behavior of divertor by plasma irradiation (tungsten)[1].
- Expansion to other materials from tungsten to investigate future plasma facing materials for DEMO reactor[4].



Multi-hierarchy physics group

Objectives :

- **Development of numerical approaches such as the multi-hierarchy model [1][4]**
- **Clarification of physics behind complex plasma behaviors for modeling the phenomena[1]**

objective	Task	2013	2014	2015	2016-2020	2021-2025
				New PS	PS upgrade	
Extending hierarchy	Full Extended MHD(XMHD) simulation	Two-fluid effects on instability of LHD(MUTSU/MINOS) AMR module development		XMHD Large Eddy Simulation (LES) of pressure-driven instability in LHD (MUTSU/MINOS)		LES of MHD activity in LHD for long duration (MUTSU/MINOS)
	Equilibrium and stability analysis	Finite-β plasma with two-fluid and FLR effects			Equilibrium model with flow and particle effects	Stability analysis of equilibria with flow and particle effects
Multi-hierarchy	Real-space interlocking	MHD-PIC interlocking in slab (MARIS)		XMHD-PIC interlocking in slab/non-rectangular geometry(MARIS)		MARIS simulation on instabilities in curved geometry (MARIS)
		Magnetic reconnection simulation in slab with /without guided magnetic field on instabilities (PASMO,MARIS)				
	EM PIC simulations			Code upgrade (PASMO) for EXA-scale HPC; extension of the code for non-rectangular geometry		
	ES PIC simulations	3D code development			3D detatched divertor plasma simulation	
			1D detatched divertor plasma simulation			

Simulation Science Basis Group

Objectives :

- Developing methodologies and techniques of scientific visualization and simulation [1]
- Contribution to the design of FFHR/DEMO reactor [4]

New PS *PS upgraded*

objective	task	2013	2014	2015	2016-2020	2021-2025
Development of light-weight and fast neoclassical transport simulation			• Development of the local version of FORTEC-3D (downsizing of the global version)		• Implementation of multi-species collision and Accelerators (Xeon Phi, random-number generator)	• PC-cluster for local FORTEC-3D □ Integrated to TASK3D
Virtual-Reality Visualization Research	Upgrade of VR system		• Upgrade of Linux system		• Upgrade of PC cluster system • Upgrade of VR projectors	• Upgrade of Linux system
	Sophistication of visualization software	• Expression of Experiment data of dust trajectories • Propagation of millimeter wave in ECH miter bend	• Efficient expression of Experiment data of dust trajectories • Visualization environment by desktop type VR system	• Expression of Experiment data of dust trajectories	• Visualization of simulation results on plasma flow • Effective visualization of vector field • Visualization of particle data • Visualization of DEMO reactor data	
In-situ Visualization		• Development of VISMO	• Optimization of VISMO	• Sophisticati-on of VISMO	• Enhancement of VISMO	
Application of Physical Random Number Generator		• Considerati-on of QRNG	• Development of Monte-Carlo Calculation method by using physical Random Number Generator			
Development of Parallel Programming Language			• Consideration of XcalableMP (XMP) specification and implementation of performance estimation			

Activities following the current needs and seeds.

Integrated Transport Code Group

Objectives :

- **Further development and application (validation) of the integrated transport analysis suite, TASK3D-a [2]**
- **Facilitating the development of predictive version, TASK3D-p, and its programmatic application for higher-performance LHD plasmas and FFHR-d1 scenario development [2,4]**

New PS *PS upgraded*

objective	task	2013	2014	2015	2016-2020	2021-2025
Analysis suite, TASK3D-a ↕ *Common modules* Predictive suite, TASK3D-p	Further extension of physics modules and applications (validation) against LHD experiment	(a01)+ • GSRAKE (NC diffusion, ambipolar Er) • AURORA (core neutral) • GIOTA + ISH-CDB (Stellarator-Heliotron database) • LHDGauss, TRAVIS (ECH) → **a02** (2015) **Further extension** (indirect-implementation, link to large-scale simulation) • FORTEC-3D, PENTA, SFINCS (plasma flow) • GKV-X (gyrokinetic) • AE3D, DELTA5D (EP/AE) • Trials have been made with EMC3/EIRENE (neutral) • (being conducted) establishment of neutron production rate calculation tool (2014) Contributions to 5 IAEA-FEC presentations			*LHD deuterium experiment* • Validation of neutron production rate calculation • Facilitating integration (Enhancing collab. with other groups in NSRP) ✓ local version of FORTEC-3D ✓ MEGA ✓ EMC3-EIRENE (core-edge integration) etc.	• Strengthening activities related to burning plasma issues (towards **Numerical Helical Test Reactor, NHTR**) • Further integration (Enhancing collab. with other groups in NSRP)
	Prediction toward higher-performance LHD and FFHR-d1	• Deduction and its implementation of ion heat diffusivity based on ITG simulations (GKV-X) for LHD • Collaboration with **Fusion Engineering Research Project (FERP)** : implementation of TASK3D-a modules for energy-balance analysis, start-up scenario → **Basis for TASK3D-p** (2014) Contribution to 1 IAEA-FEC presentation		• Implementa-tion of several transport models → comparative study on FFHR-d1 start-up scenario	• Predictions (~10 keV range) by modules validated against LHD (H/D) • FFHR-d1 start-up to whole-duration simulation • Plasma control scenario development	

Increasing accuracy (eg., H/He comparison)

Enhancement of validation activity against LHD experiment (more experimentalists to be involved to facilitate the data handling)

Facilitation of TASK3D-p activities

Provisional version of NHTR

"Plasma Simulator" is planned to be upgraded to a system with the total peak performance of more than 10 Petaflops in 2019

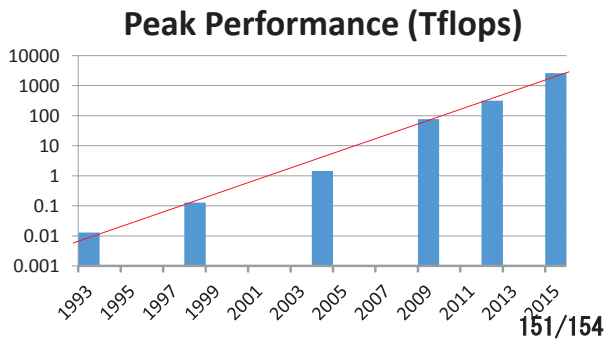
FUJITSU PRIMEHPC FX100
(peak speed: **~2.6PF**
memory: **~81TB**
period: 2015-2019)

HITACHI SR16000/M2
(peak speed: **315TF**
memory: **40TB**
period: 2012 – 2015)

HITACHI SR16000/L2
(peak speed:**77TF**
memory: **16TB**
period: 2009 – 2012)

Next system
(peak speed:**10PF ~,** period:2019-)

- **Plasma Simulator** was replaced by FUJITSU PRIMEHPC FX100 with the total peak performance of about **2.6 Petaflops**, and the total main memory of about 81TB in 2015.
- In the next upgrade, the peak performance will be raised at least by four times.



Summary of third mid-term plans (1)

[1] Development of research system and numerical techniques supporting large-scale simulations

- Next PS is planned to have the peak performance of more than 10 Pflops.
- Optimization study of simulation codes for GPU and many core systems toward exascale computing.
- Modeling study on edge plasma physics, divertor material physics, core/edge coupling, plasma-wall interaction, multi-scale coupling, other numerical methodologies, and techniques for large-scale simulation and scientific visualization.

[2] Validation studies with various experimental plasmas

- Further development of simulation codes through their validation in LHD deuterium experiment, and other experiments including ITER
- Three-dimensional stability and transport analyses of core/edge plasmas
- Further development of predictive version of the integral transport code, TASK3D-p, and its programmatic application for higher-performance LHD plasmas

Summary of third mid-term plans (2)

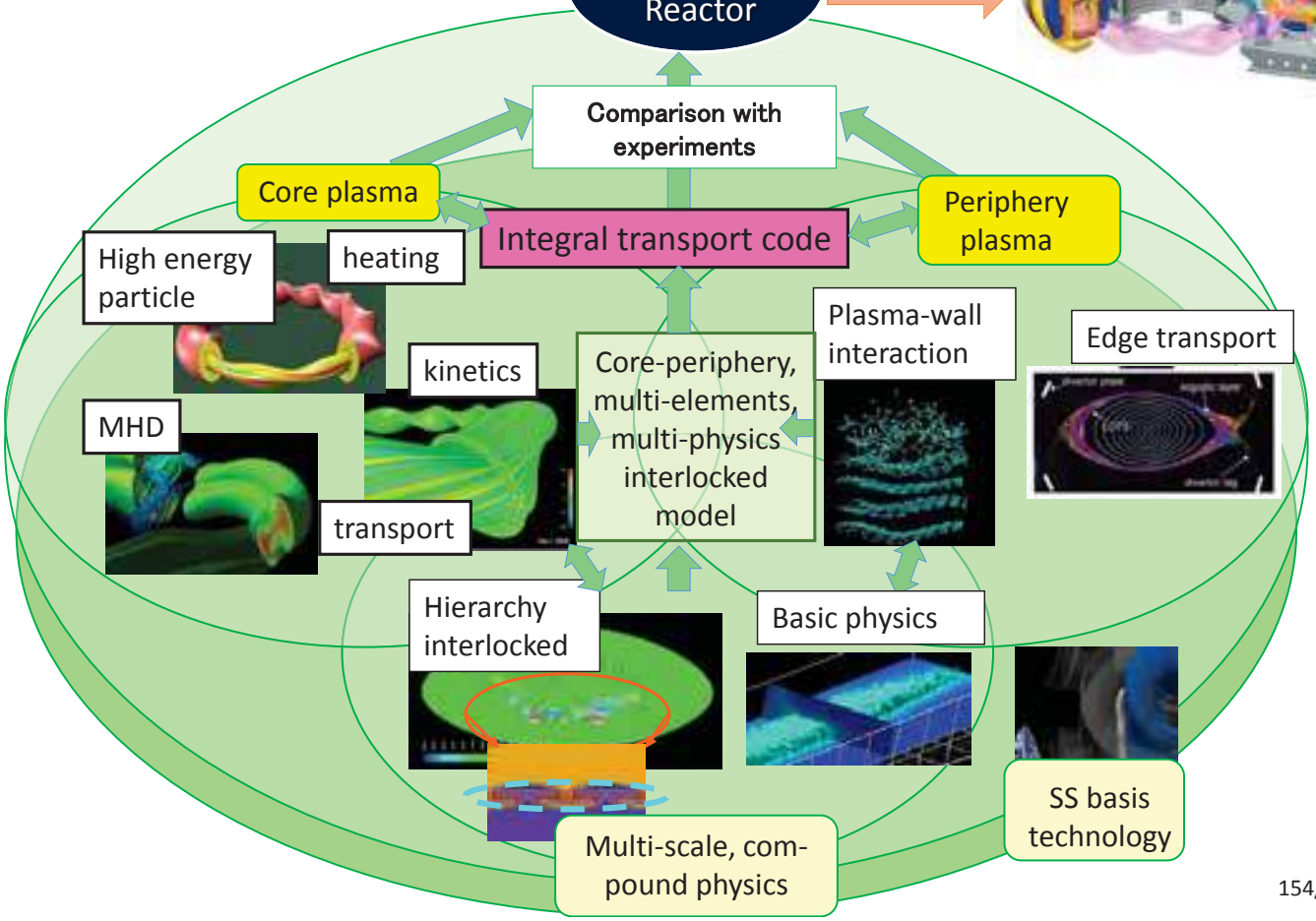
[3] Code improvement for burning plasmas, and verification of simulation codes through benchmarking with other codes

- Improve MEGA code with kinetic bulk plasma for predictive simulation of burning plasmas
- Clarification and validation of multi-species/electromagnetic turbulent transport and neoclassical transport codes in general 3D configurations
- Further development of GKV for LHD-DD and ITER burning plasma experiments

[4] Research toward integration of all physics elements, and design study of DEMO/FFHR

- Expansion to other materials from tungsten to investigate future plasma facing materials for DEMO reactor
- Quantitative prediction of stability boundary for helical DEMO
- Contribution of TASD3D-p for FFHR-d1 scenario development
- Further development of compact reduced models for turbulent and neoclassical transports, and their application to DEMO/FFHR
- Development of visualization tool of DEMO reactor data

Toward construction of Numerical Test Reactor



Documents

2. List of Published Papers Related NSRP in 2010-2015

論文リスト（2010 - 2015年）/ Published Papers related to NSRP in 2010-2015

論文リスト 2010年 / Published Papers related to NSRP in 2010

No	著者 / Author	タイトル / Title	雑誌名 / Journal	Vol	Issue	Page	Year	査読有/無
1	H. Ohtani, N. Ohno, D. Matsuoka, R. Horiuchi, Y. Tamura, A. Kageyama, S. Ishiguro	Application of Virtual Reality Technology to Research of Plasma Physics and Fusion Plasmas	Bulletin of the American Physical Society	55	15		2010	unrefereed
2	S. Satake, Y. Idomura, H. Sugama, T. Watanabe	Benchmark test of drift-kinetic and gyrokinetic codes through neoclassical transport simulations	Computer Physics Communications	181	6	1069-1076	2010	refereed
3	T. Goto, Y. Suzuki, K. Watanabe, S. Imagawa, A. Sagara	Core Plasma Design of a Heliotron Reactor	Contributions to Plasma Physics	50	6-7	620-623	2010	refereed
4	M. Yokoyama, S. Matsuoka, H. Funaba, K. Ida, K. Nagaoka, M. Yoshinuma, Y. Takeiri, O. Kaneko	Considerations from the Viewpoint of Neoclassical Transport Towards Higher Ion Temperature Heliotron Plasmas	Contributions to Plasma Physics	50	6-7	586-589	2010	refereed
5	K. Toi, M. Isobe, M. Osakabe, K. Ogawa, D. Spong, Y. Todo	Overview of Studies on Energetic-Ion-Driven MHD Instabiities in Stellarator/Helical Plasmas and Comparison with Tokamaks	Contributions to Plasma Physics	50	6-7	493-500	2010	refereed
6	H. Sugama, T. Watanabe	Enhancement of Residual Zonal Flows in Helical Systems with Equilibrium Radial Electric Fields	Contributions to Plasma Physics	50	6-7	571-575	2010	refereed
7	H. Yamada, K. Watanabe, S. Sakakibara, Y. Suzuki, S. Ohdachi, M. Kobayashi, H. Funaba	Study of High-Beta Plasmas in a Helical System	Contributions to Plasma Physics	50	6-7	480-486	2010	refereed
8	Y. Narushima, F. Castejón, K. Watanabe, S. Sakakibara, T. Estrada, F. Medina, D. Lopez-Bruna, M. Yokoyama, K. Ida	Experimental Study of the Effect of Poloidal Flow on Stability of Magnetic Islands in LHD and TJ-II	Contributions to Plasma Physics	50	6-7	529-533	2010	refereed
9	S. Ohdachi, R. Sakamoto, J. Miyazawa, T. Morisaki, S. Masuzaki, H. Yamada, K. Watanabe, V. Jacobo, N. Nakajima, F. Watanabe, M. Takeuchi, K. Toi, S. Sakakibara, Y. Suzuki, Y. Narushima, I. Yamada, T. Minami, K. Narihara, K. Tanaka, T. Tokuzawa, K. Kawahata	Density Collapse Events Observed in the Large Helical Device	Contributions to Plasma Physics	50	6-7	552-557	2010	refereed

No	著者 / Author	タイトル / Title	雑誌名 / Journal	Vol	Issue	Page	Year	査読有/無
10	K. Ida, M. Yoshinuma, K. Nagaoka, M. Osakabe, S. Morita, M. Goto, H. Funaba, M. Yokoyama, K. Ikeda, H. Nakano, K. Tsumori, Y. Takeiri, O. Kaneko, Y. Sakamoto	Ion Internal Transport Barrier in the Large Helical Device	Contributions to Plasma Physics	50	6-7	558-561	2010	refereed
11	N. Tamura, K. Ida, S. Inagaki, K. Tanaka, T. Tokuzawa, K. Itoh, T. Shimozuma, S. Kubo, H. Tsuchiya, Y. Nagayama, K. Kawahata, S. Sudo, H. Yamada	Characteristics of nonlocally-coupled transition of the heat transport in LHD	Contributions to Plasma Physics	50	6-7	514-519	2010	refereed
12	K. Inai, K. Ohya, G. Kawamura, Y. Tomita	Electron Velocity Distributions at a Sheath Edge in the Presence of Secondary Electron Emission from a Metal Surface	Contributions to Plasma Physics	50	3-5	458-463	2010	refereed
13	G. Kawamura, Y. Tomita, M. Kobayashi, M. Tokitani, S. Masuzaki, A. Kirschner	Analysis of Carbon Deposition on the First Wall of LHD by Monte Carlo Simulation	Contributions to Plasma Physics	50	3-5	451-457	2010	refereed
14	A. Ito, K. Ohya, K. Inai, H. Nakamura	Dependency of Tritium Retention in Graphite on Temperature Control of Molecular Dynamics	Contributions to Plasma Physics	50	3-5	464-469	2010	refereed
15	Y. Tomita, G. Kawamura, Y. Pan, L. Yan	Acceleration and Redeposition of a Dust Particle in SOL/Divertor Plasma of HL-2A Tokamak	Contributions to Plasma Physics	50	3-5	426-431	2010	refereed
16	T. Yamamoto, Y. Nagayama, H. Nakanishi, S. Ishiguro, S. Takami, K. Tsuda, S. Okamura	Configuration of the Virtual Laboratory for Fusion Researches in Japan	Fusion Engineering and Design	85	3-4	637-640	2010	refereed
17	Y. Nagayama, M. Emoto, Y. Kozaki, H. Nakanishi, S. Sudo, T. Yamamoto, K. Hiraki, S. Urushidani	A proposal for the ITER remote participation system in Japan	Fusion Engineering and Design	85	3-4	535-539	2010	refereed
18	H. Yamada, K. Kawahata, T. Muto, N. Ohyabu, Y. Takeiri, S. Imagawa, K. Ida, T. Mito, Y. Nagayama, T. Shimozuma, K. Watanabe, M. Kobayashi, R. Kumazawa, S. Masuzaki, T. Morisaki, J. Miyazawa, K. Nagaoka, Y. Narushima, S. Sakakibara, R. Sakamoto, K. Toi, M. Yokoyama, O. Kaneko, A. Komori, O. Motojima	LHD: PROGRESS IN THE INTEGRATED DEVELOPMENT OF THE HELICAL SYSTEM	Fusion Science and Technology	58	1	12-28	2010	refereed

No	著者 / Author	タイトル / Title	雑誌名 / Journal	Vol	Issue	Page	Year	査読有/無
19	H. Funaba, K. Watanabe, S. Sakakibara, S. Murakami, I. Yamada, K. Narihara, K. Tanaka, T. Tokuzawa, M. Osakabe, Y. Narushima, M. Yokoyama, S. Ohdachi, Y. Takeiri, H. Yamada, K. Kawahata	LOCAL TRANSPORT PROPERTY OF HIGH-BETA PLASMAS ON LHD	Fusion Science and Technology	58	1	141-149	2010	refereed
20	K. Watanabe, Y. Suzuki, S. Sakakibara, T. Yamaguchi, Y. Narushima, Y. Nakamura, K. Ida, N. Nakajima, H. Yamada	Characteristics of MHD Equilibrium and Related Issues on LHD	Fusion Science and Technology	58	1	160-175	2010	refereed
21	N. Nakajima, M. Sato, Y. Nakamura, A. Fukuyama, S. Murakami, A. Wakasa, K. Watanabe, S. Toda, H. Yamada	ACTIVITIES ON INTEGRATED SIMULATIONS IN LHD	Fusion Science and Technology	58	1	289-296	2010	refereed
22	K. Ichiguchi, H. Miura, N. Mizuguchi, Y. Suzuki, N. Nakajima, Y. Nakamura	Theoretical MHD Analyses of LHD Plasmas	Fusion Science and Technology	58	1	242-255	2010	refereed
23	M. Yoshinuma, K. Ida, M. Yokoyama, M. Osakabe, K. Nagaoka, S. Morita, M. Goto, N. Tamura, C. Suzuki, S. Yoshimura, H. Funaba, Y. Takeiri, K. Ikeda, K. Tsumori, O. Kaneko	Spontaneous Toroidal Flow and Impurity Hole in the High Ion Temperature Plasma on LHD	Fusion Science and Technology	58	1	103-112	2010	refereed
24	K. Tanaka, K. Kawahata, T. Tokuzawa, T. Akiyama, M. Yokoyama, M. Shoji, C. Michael, L. Vyacheslavov, S. Murakami, A. Wakasa, A. Mishchenko, K. Muraoka, S. Okajima, H. Takenaga	PARTICLE TRANSPORT OF LHD	Fusion Science and Technology	58	1	70-90	2010	refereed
25	M. Yoshinuma, K. Ida, M. Yokoyama, M. Osakabe, K. Nagaoka	Charge-Exchange Spectroscopy with Pitch-Controlled Double-Slit Fiber Bundle on LHD	Fusion Science and Technology	58	1	375-382	2010	refereed
26	Y. Todo, S. Murakami, T. Yamamoto, A. Fukuyama, D. Spong, S. Yamamoto, M. Osakabe, N. Nakajima	NUMERICAL ANALYSES OF ENERGETIC PARTICLES IN LHD	Fusion Science and Technology	58	1	277-288	2010	refereed

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27	K. Itoh, H. Sugama, T. Watanabe, O. Yamagishi, S. Toda, N. Kasuya, R. Kanno, M. Nunami	MICROINSTABILITIES, TURBULENT TRANSPORT, AND STRUCTURE FORMATION IN HELICAL PLASMAS	Fusion Science and Technology	58	1	256-268	2010	refereed
28	Y. Narushima, K. Watanabe, Y. Suzuki, S. Sakakibara, K. Ida, K. Narihara, N. Ohyabu	SPONTANEOUS DYNAMICS OF MAGNETIC ISLANDS DEPENDING ON PLASMA PARAMETERS IN LHD	Fusion Science and Technology	58	1	194-199	2010	refereed
29	T. Ido, A. Shimizu, M. Nishiura, S. Kato, H. Nakano, S. Ohshima, M. Yokoyama, S. Murakami, A. Wakasa, S. Nakamura, M. Yokota, K. Tsukada, H. Ogawa, T. Inoue	DEVELOPMENT OF 6-MeV HEAVY ION BEAM PROBE ON LHD	Fusion Science and Technology	58	1	436-444	2010	refereed
30	K. Toi, M. Isobe, M. Osakabe, F. Watanabe, K. Ogawa, S. Yamamoto, N. Nakajima, D. Spong, K. Ida, T. Ido, T. Ito, S. Morita, K. Nagaoka, K. Narihara, M. Nishiura, S. Ohdachi, S. Sakakibara, A. Shimizu, K. Tanaka, Y. Todo, T. Tokuzawa, A. Weller	MHD Modes Destabilized by Energetic Ions on LHD	Fusion Science and Technology	58	1	186-193	2010	refereed
31	M. Emoto, M. Yoshida, H. Nakanishi, T. Yamamoto, T. Watanabe, K. Watanabe, M. Shoji, Y. Nagayama	Remote Participation for the LHD Experiment	Fusion Science and Technology	58	1	458-464	2010	refereed
32	T. Shimozuma, M. Yokoyama, K. Ida, Y. Takeiri, S. Kubo, S. Murakami, A. Wakasa, H. Idei, Y. Yoshimura, T. Notake, S. Inagaki, N. Tamura, K. Toi, N. Ohyabu, M. Osakabe, K. Ikeda, K. Tsumori, Y. Oka, K. Nagaoka, O. Kaneko, I. Yamada, K. Narihara, Y. Nagayama, S. Muto, K. Tanaka, T. Tokuzawa, S. Morita, M. Goto, M. Yoshinuma, H. Funaba, T. Morisaki, K. Watanabe, J. Miyazawa, T. Muto, T. Watari, K. Ohkubo	Improvement of Plasma Core Confinement Via Electron-Root Realization by Strongly Focused ECRH in LHD: Core Electron-Root Confinement	Fusion Science and Technology	58	1	38-45	2010	refereed

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33	M. Yokoyama, A. Wakasa, S. Murakami, K. Watanabe, S. Satake, S. Nishimura, H. Sugama, N. Nakajima, H. Funaba, Y. Nakamura	ROLE OF NEOCLASSICAL TRANSPORT AND RADIAL ELECTRIC FIELD IN LHD PLASMAS	Fusion Science and Technology	58	1	269-276	2010	refereed
34	S. Imagawa, A. Sagara, H. Yamada, N. Nakajima, A. Komori, O. Motojima	PROSPECTS TOWARD AN INTEGRATED HELIOTRON FUSION REACTOR	Fusion Science and Technology	58	1	593-598	2010	refereed
35	K. Nagaoka, Y. Takeiri, S. Morita, K. Ida, M. Yokoyama, M. Yoshinuma, H. Funaba, S. Murakami, T. Minami, K. Tanaka, T. Ido, A. Shimizu, K. Ikeda, M. Osakabe, K. Tsumori, O. Kaneko	ION HEATING EXPERIMENTS AND IMPROVEMENT OF ION HEAT TRANSPORT IN LHD	Fusion Science and Technology	58	1	46-52	2010	refereed
36	N. Tamura, S. Inagaki, T. Tokuzawa, C. Michael, K. Tanaka, K. Ida, T. Shimozuma, S. Kubo, K. Itoh, Y. Nagayama, K. Kawahata, S. Sudo, A. Komori	Experimental Study on Nonlocality of Heat Transport in LHD	Fusion Science and Technology	58	1	122-130	2010	refereed
37	H. Nakanishi, M. Ohsuna, M. Kojima, S. Imazu, M. Nonomura, M. Hasegawa, K. Nakamura, A. Higashijima, M. Yoshikawa, M. Emoto, T. Yamamoto, Y. Nagayama, K. Kawahata	DATA ACQUISITION AND MANAGEMENT SYSTEM OF LHD	Fusion Science and Technology	58	1	445-457	2010	refereed
38	Y. Tamura, H. Ohtani, T. Umetani, H. Nakamura	Haptization on Numerical Simulation of Plasma	IEEE Transactions on Plasma Science	38	10	2974-2979	2010	refereed
39	T. Moritaka, H. Usui, M. Nunami, Y. Kajimura, M. Nakamura, M. Matsumoto	Full Particle-in-Cell Simulation Study on Magnetic Inflation Around a Magneto Plasma Sail	IEEE Transactions on Plasma Science	38	9	2219-2228	2010	refereed
40	S. Ishiguro, S. Usami, R. Horiuchi, H. Ohtani, A. Maluckov, M. Skoric	Multi-scale simulation for plasma science	Journal of Physics: Conference Series	257	1	012026-1-9	2010	unrefereed
41	H. Nagatomo, T. Johzaki, A. Sunahara, H. Shiraga, H. Sakagami, H. Cai, K. Mima	Controlling dynamics of imploded core plasma for fast ignition	Journal of Physics: Conference Series	244	2	022050-1-4	2010	unrefereed
42	T. Johzaki, H. Nagatomo, A. Sunahara, H. Cai, H. Sakagami, K. Mima	Integrated simulations of core heating in cone-guiding fast ignition, FIREX-I	Journal of Physics: Conference Series	244	2	022040-1-4	2010	unrefereed

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43	M. Hata, H. Sakagami, A. Sunahara, T. Johzaki, H. Nagatomo	Effects of preformed plasma of CH foam on fast electron generation	Journal of Physics: Conference Series	244	2	022037-1-4	2010	unrefereed
44	A. Iwamoto, T. Fujimura, M. Nakai, K. Nagai, T. Norimatsu, H. Azechi, R. Maekawa, H. Sakagami	Study on possible fuel layering sequence for FIREX target	Journal of Physics: Conference Series	244	3	032039-1-032039-4	2010	refereed
45	T. Ozaki, M. Koga, H. Shiraga, H. Azechi, H. Sakagami	Development of the compact electron spectrometer for the FIREX-I Project in Gekko XII	Journal of Physics: Conference Series	244	2	022056-1-022056-4	2010	refereed
46	H. Miura	Contributions of small scales to statistics of Hall MHD turbulence	Journal of Plasma and Fusion Research	9		535-540	2010	refereed
47	R. Ishizaki, N. Nakajima	Pellet Ablation in Helical Plasmas	Journal of Plasma and Fusion Research	9		471-478	2010	refereed
48	T. Voslion, O. Agullo, P. Beyer, M. Yagi, S. Benkadda, X. Garbet, K. Itoh, S. Itoh	Shear flow effects on double tearing mode global magnetic reconnection	Journal of Plasma and Fusion Research SERIES	9		574-579	2010	refereed
49	N. Kasuya, S. Nishimura, M. Yagi, K. Itoh, S. Itoh, N. Ohyabu	Turbulence Diagnostic Simulator for Analyzing Structural Formation in Magnetically Confined Plasmas	Journal of Plasma and Fusion Research SERIES	9		523-528	2010	refereed
50	K. Araki, H. Miura	Visualization of energy transfer to magnetic energy by rolling-up vortices with uniform background magnetic field	Journal of Plasma and Fusion Research SERIES	9		446-451	2010	refereed
51	T. Moritaka, M. Nunami, H. Usui	Development of full particle-in-cell simulation code with adaptive mesh refinement technique	Journal of Plasma and Fusion Research	9		586-591	2010	refereed
52	Y. Nagayama, M. Emoto, Y. Kozaki, H. Nakanishi, S. Sudo, T. Yamamoto, K. Hiraki, N. Tanida, M. Inaba, S. Urushidani	A Proposal for the Global Remote Participation System	Journal of Plasma and Fusion Research SERIES	9		147-151	2010	refereed
53	A. Takayama, K. Shimizu, Y. Tomita, T. Takizuka	A new framework for integrated simulation model using MPMD approach	Journal of Plasma and Fusion Research	9		604-609	2010	refereed
54	S. Itoh, K. Itoh	On Distance of Turbulent Plasma from Thermal Equilibrium	Journal of the Physical Society of Japan	79	12	124501-1-124501-5	2010	refereed
55	T. Yamada, S. Itoh, S. Inagaki, Y. Nagashima, K. Kamataki, H. Arakawa, M. Yagi, A. Fujisawa, K. Itoh	Study of Amplitude Correlation Technique in a Cylindrical Magnetized Plasma	Journal of the Physical Society of Japan	79	8	085001-1-085001-2	2010	refereed
56	S. Sugita, M. Yagi, S. Itoh, K. Itoh	Interchange Turbulence and Radial Transport in Tokamak Scrape-Off Layer Dominated by Meso-scale Structure	Journal of the Physical Society of Japan	79	4	044502-1-044502-8	2010	refereed
57	K. Kamataki, K. Itoh, S. Itoh, A. Fujisawa, S. Inagaki, Y. Nagashima, M. Yagi, T. Yamada	Statistical Analysis Technique for Estimation of Causal Relationship in Plasma Turbulence	Journal of the Physical Society of Japan	79	2	024501-1-024501-5	2010	refereed

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58	K. Kamataki, K. Itoh, S. Itoh, A. Fujisawa, S. Inagaki, Y. Nagashima, M. Yagi, T.	Statistical Analysis Technique for Estimation of Causal Relationship in Plasma Turbulence	Journal of the Physical Society of Japan	79	2	024501-1-024501-5	2010	refereed
59	Y. Todo, H. Berk, B. Breizman	Nonlinear magnetohydrodynamic effects on Alfvén eigenmode evolution and zonal flow generation	Nuclear Fusion	50	8	084016-1-084016-9	2010	refereed
60	K. Ida, M. Yoshinuma, K. Nagaoka, M. Osakabe, S. Morita, M. Goto, M. Yokoyama, H. Funaba, S. Murakami, K. Ikeda, H. Nakano, K. Tsumori, Y. Takeiri, O. Kaneko	Spontaneous Toroidal Rotation Driven by the Off-diagonal Term of Momentum and Heat Transport in the Plasma with Ion Internal Transport Barrier in LHD	Nuclear Fusion	50	6	064007	2010	refereed
61	S. Inagaki, N. Tamura, K. Ida, S. Kubo, T. Shimozuma, Y. Nagayama, K. Kawahata, S. Sudo, A. Fujisawa, K. Itoh, S. Itoh	Internal Transport Barrier Formation Induced by Edge Perturbation on LHD	Nuclear Fusion	50	6	064012-1-5	2010	refereed
62	N. Kasuya, M. Yagi, K. Itoh, S. Itoh	Selective formation of streamers in magnetized cylindrical plasmas	Nuclear Fusion	50	5	054003-1-054003-8	2010	refereed
63	S. Nishimura, M. Yagi, K. Itoh, S. Itoh, S. Benkadda	Locking of magnetic island rotation by static error field	Nuclear Fusion	50	5	054007-1-054007-12	2010	refereed
64	K. Itoh	Summary of IAEA Technical Meeting on Theory of Plasma Instabilities	Nuclear Fusion	50	5	054001	2010	refereed
65	H. Miura, N. Nakajima	Influences of ballooning modes with moderate wave number on MHD equilibrium in LHD	Nuclear Fusion	50	5	054006-1-054006-13	2010	refereed
66	K. Nagasaki, G. Motojima, S. Kobayashi, S. Yamamoto, T. Mizuuchi, H. Okada, K. Hanatani, S. Konoshima, K. Masuda, Y. Nakamura, S. Watanabe, K. Mukai, K. Hosaka, K. Kowada, S. Mihara, Y. Yoshimura, Y. Suzuki, A. Fernández, A. Cappa, F. Sano	Effect of magnetic field ripple on electron cyclotron current drive in Heliotron J	Nuclear Fusion	50	2	025003-1-7	2010	refereed
67	Y. Hamada, T. Watari, A. Nishizawa, O. Yamagishi, K. Narihara, Y. Kawasumi, T. Ido, M. Kojima, K. Toi	GAM generation by drift waves in JIPP T-IIU tokamak core plasmas	Nuclear Fusion	50	2	025001-1-9	2010	refereed
68	K. Nishihara, J. Wouchuk, C. Matsuoka, R. Ishizaki, V. Zhakhovsky	Richtmyer-Meshkov instability: theory of linear and nonlinear evolution	Philosophical Transactions of The Royal Society A (Phll. Trans. R. Soc. A)	368	1916	1769-1807	2010	refereed

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69	T. Yamada, S. Itoh, S. Inagaki, Y. Nagashima, N. Kasuya, K. Kamataki, H. Arakawa, T. Kobayashi, M. Yagi, A. Fujisawa, K. Itoh	Observation of Quasi-Two-Dimensional Nonlinear Interactions in a Drift-Wave Streamer	Physical Review Letters	105	22	225002-1-225002-4	2010	refereed
70	K. Toi, F. Watanabe, T. Tokuzawa, K. Ida, S. Morita, T. Ido, A. Shimizu, M. Isobe, K. Ogawa, D. Spong, Y. Todo, S. Ohdachi, S. Sakakibara, S. Yamamoto, S. Inagaki, K. Narihara, M. Osakabe, K. Nagaoka, Y. Narushima, K. Watanabe, H. Funaba, M. Goto, K. Ikeda, T. Ito, O. Kaneko, S. Kubo, S. Murakami, T. Minami, J. Miyazawa, Y. Nagayama, M. Nishiura, Y. Oka, R. Sakamoto, T. Shimozuma, Y. Takeiri, K. Tanaka, K. Tsumori, I. Yamada, M. Yoshinuma, K. Kawahata, A. Komori	Observation of Reversed-Shear Alfvén Eigenmodes Excited by Energetic Ions in a Helical Plasma	Physical Review Letters	105	14	145003-1-145003-4	2010	refereed
71	A. Fujisawa, A. Shimizu, K. Itoh, Y. Nagashima, T. Yamada, S. Inagaki, K. Matsuoka, S. Itoh	Wavelet analyses using parallel computing for plasma turbulence studies	Physics of Plasmas	17	10	104503-1-104503-3	2010	refereed
72	S. Nishimura, H. Sugama, H. Maaßberg, C. Beidler, S. Murakami, Y. Nakamura, S. Hirooka	A convergence study for the Laguerre expansion in the moment equation method for neoclassical transport in general toroidal plasmas	Physics of Plasmas	17	8	082510-1-082510-8	2010	refereed
73	A. Ishizawa, N. Nakajima	Turbulence driven magnetic reconnection causing long-wavelength magnetic islands	Physics of Plasmas	17	7	072308-1-072308-7	2010	refereed
74	A. Ishizawa, P. Diamond	Ion-temperature gradient modes affected by helical magnetic field of magnetic islands	Physics of Plasmas	17	7	074503-1-074503-3	2010	refereed
75	S. Maeyama, A. Ishizawa, T. Watanabe, M. Škorić, N. Nakajima, S. Tsuji-Iio, H. Tsutsui	Effects of time-varying E × B flow on slab ion-temperature-gradient turbulence	Physics of Plasmas	17	2010	062305-1-062305-9	2010	refereed
76	K. Saito, K. Ichiguchi, N. Ohyabu	Interaction between Static Magnetic Islands and Interchange modes in a Straight Heliotron Plasma with High Resistivity	Physics of Plasmas	17	6	062504-1-062504-14	2010	refereed

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77	T. Yamada, S. Itoh, S. Inagaki, Y. Nagashima, S. Shinohara, N. Kasuya, K. Terasaka, K. Kamataki, H. Arakawa, M. Yagi, A. Fujisawa, K. Itoh	Two-dimensional bispectral analysis of drift wave turbulence in a cylindrical plasma	Physics of Plasmas	17	5	052313-1-052313-10	2010	refereed
78	K. Uzawa, A. Ishizawa, N. Nakajima	Propagation of magnetic island due to self-induced zonal flow	Physics of Plasmas	17	4	042508-1-042508-8	2010	refereed
79	M. Nakata, T. Watanabe, H. Sugama, W. Horton	Formation of coherent vortex streets and transport reduction in electron temperature gradient driven turbulence	Physics of Plasmas	17	4	042306-1-042306-13	2010	refereed
80	D. Spong, E. D'Azevedo, Y. Todo	Clustered frequency analysis of shear Alfvén modes in stellarators	Physics of Plasmas	17	2	022106-1-022106-12	2010	refereed
81	F. Sano, T. Mizuuchi, K. Nagasaki, K. Hanatani, H. Okada, Y. Nakamura, T. Minami, S. Kobayashi, S. Yamamoto, S. Konoshima, S. Ohshima, M. Takeuchi, Y. Ijiri, K. Yaguchi, T. Senju, M. Shibano, K. Tohshi, K. Sakamoto, A. Matsuyama, K. Mukai, K. Minami, S. Kishi, H. Lee, Y. Takabatake, H. Yashiro, K. Nomura, M. Suwa, H. Yoshino, S. Murakami, T. Muto, Y. Takeiri, K. Nagaoka, S. Okamura, K. Watanabe, M. Yokoyama, Y. Suzuki, Y. Yoshimura, S. Nishimura, N. Tamura, S. Sakakibara, G. Motojima, N. Nishino, T. Fukuda, Y. Nakashima, Z. Feng, Q. Yang, A. Fernández, A. Cappa, V. Tribaldos, B. Blackwell, V. Chechkin	Physics of Heliotron J Confinement	Plasma and Fusion Research	5	Special Issue2	S2003-1-S2003-6	2010	refereed
82	R. Ishizaki, N. Nakajima	Plasmoid Motion in Helical Plasmas	Plasma and Fusion Research	5	2	S2060	2010	refereed
83	K. Kamataki, S. Itoh, S. Inagaki, H. Arakawa, Y. Nagashima, T. Yamada, M. Yagi, A. Fujisawa, K. Itoh	ECRH Superposition on Linear Cylindrical Helicon Plasma in the LMD-U	Plasma and Fusion Research	5	Special Issue2	S2046-1-S2046-4	2010	refereed

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84	H. Arakawa, S. Inagaki, Y. Nagashima, T. Yamada, K. Kamataki, T. Kobayashi, S. Sugita, M. Yagi, N. Kasuya, A. Fujisawa, S. Itoh, K. Itoh	Probability Density Function of Density Fluctuations in Cylindrical Helicon Plasmas	Plasma and Fusion Research	5	Special Issue2	S2044-1-S2044-3	2010	refereed
85	T. Yamada, S. Itoh, S. Inagaki, Y. Nagashima, S. Shinohara, N. Kasuya, K. Terasaka, K. Kamataki, H. Arakawa, M. Yagi, A. Fujisawa, K. Itoh	Nonlinear Mode Couplings in a Cylindrical Magnetized Plasma	Plasma and Fusion Research	5	Special Issue2	S2016-1-S2016-4	2010	refereed
86	K. Araki, H. Miura	Orthonormal Divergece-free Wavelet Analysis of Energy Transfer in Hall-MHD Turbulence	Plasma and Fusion Research	5	special issue 2	S2048	2010	refereed
87	Y. Tamura, S. Fujiwara, H. Nakamura	Haptization of Molecular Dynamics Simulation with Thermal Display	Plasma and Fusion Research	5	Special Issue2	S2107-1-S2107-4	2010	refereed
88	A. Saitoh, T. Itoh, A. Kamitani, N. Matsui, H. Nakamura	Application of Two Dimensional Extended Boundary Node Method to Potential Problem	Plasma and Fusion Research	5	Special Issue2	S2108-1-S2108-4	2010	refereed
89	T. Itoh, A. Saitoh, A. Kamitani, H. Nakamura	Three Dimensional Extended Boundary Node Method to Potential Problem	Plasma and Fusion Research	5	Special Issue2	S2111-1-S2111-4	2010	refereed
90	A. Kamitani, T. Takayama, H. Nakamura	High Performance Analysis of Shielding Current Density in High Temperature Superconducting Thin	Plasma and Fusion Research	5	Special Issue2	S2112-1-S2112-4	2010	refereed
91	T. Matsui, K. Tsurusaki, R. Shirasaki, H. Nakamura	Introduction of Adhesive Force to DEM Simulation and Application to Fracture of Fragile Powder	Plasma and Fusion Research	5	Special Issue2	S2116-1-S2116-5	2010	refereed
92	K. Sawada, H. Nakamura, T. Maruoka, Y. Tamura, K. Imura, T. Saiki, H. Okamoto	FDTD simulated observation of a gold nanorod by scanning near-field optical microscopy	Plasma and Fusion Research	5	Special Issue 2	S2110-1-S2110-4	2010	refereed
93	S. Fujiwara, T. Itoh, M. Hashimoto, H. Nakamura, Y. Tamura	Effect of Molecular Rigidity on Micelle Formation in Amphiphilic Solution	Plasma and Fusion Research	5	Special Issue 2	S2114-1-S2114-4	2010	refereed
94	K. Itoh	Summary of the 19th International Toki Conference – Advanced Physics in Plasma and Fusion Research	Plasma and Fusion Research	5	Special Issue 2	S2118-1-S2118-8	2010	refereed
95	S. Nishimura, N. Kasuya, M. Yagi, K. Itoh, S. Itoh, N. Ohyabu	Numerical Diagnostics of the Electrostatic Potential Perturbed by Magnetic Islands	Plasma and Fusion Research	5	Special Issue 2	S2057-1-S2057-4	2010	refereed
96	S. Saito, A. Ito, H. Nakamura	Molecular Dynamics Simulation of the Incident Angle Dependence of Reactions between Graphene and Hydrogen Atom	Plasma and Fusion Research	5	Special Issue 2	S2076-1-S2076-4	2010	refereed
97	H. Nakamura, A. Ito, S. Saito, Y. Tamura, S. Fujiwara, N. Ohno, S. Kajita	Comparison of Hydrogen Adsorption on Diamond and Graphite Surfaces	Plasma and Fusion Research	5	Special Issue 2	S2072-1-S2072-4	2010	refereed
98	A. Ito, H. Okumura, S. Saito, H. Nakamura	Examination of Temperature Dependence of Chemical Sputtering on Graphite by Comparing the Langevin and Berendsen Thermostats	Plasma and Fusion Research	5	Special Issue 2	S2020-1-S2020-4	2010	refereed

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99	T. Ozaki, M. Koga, H. Shiraga, R. Kato, S. Kashiwagi, G. Isoyama, H. Sakagami	Calibration of Compact Electron Spectrometer for the FIREX-I Project in Gekko XII	Plasma and Fusion Research	5	Special Issue 2	S2098-1-S2098-4	2010	refereed
100	S. Toda, K. Itoh	Study of the Effect of the Helical Ripple Transport on the Confinement via Zonal Flows in Helical Plasmas	Plasma and Fusion Research	5	Special Issue 2	S2023-1-S2023-5	2010	refereed
101	K. Tanaka, C. Michael, L. Vyacheslavov, H. Funaba, M. Yokoyama, K. Ida, M. Yoshinuma, K. Nagaoka, S. Murakami, A. Wakasa, T. Ido, A. Shimizu, M. Nishiura, Y. Takeiri, O. Kaneko, K. Tsumori, K. Ikeda, M. Osakabe, K. Kawahata	Turbulence Response in the High Ti Discharge of the LHD	Plasma and Fusion Research	5	Special Issue 2	S2053-1-S2053-5	2010	refereed
102	Y. Todo, N. Nakajima, M. Sato, H. Miura	Simulation Study of Ballooning Modes in the Large Helical Device	Plasma and Fusion Research	5	Special Issue 2	S2062-1-S0262-4	2010	refereed
103	S. Morita, C. Dong, M. Goto, M. Kobayashi, S. Muto, K. Yamazaki, M. Yokoyama, H. Zhou, T. Akiyama, N. Ashikawa, Z. Cui, K. Fujii, X. Gao, M. Hasuo, K. Ida, K. Ikeda, A. Iwamae, O. Kaneko, S. Masuzaki, J. Miyazawa, T. Morisaki, K. Nagaoka, K. Narihara, S. Ohdachi, M. Osakabe, S. Sakakibara, R. Sakamoto, M. Shoji, Y. Takeiri, K. Tanaka, K. Toi, M. Tokitani, T. Tokuzawa, K. Tsumori, K. Watanabe, H. Yamada, I. Yamada, J. Yanagibayashi, M. Yoshinuma, A. Komori	Progress of Impurity-Related Physics Experiment in LHD	Plasma and Fusion Research	5	Special Issue 2	S2004-1-S2004-11	2010	refereed
104	H. Ohtani, N. Ohno, N. Mizuguchi, M. Shoji, S. Ishiguro	Simulation Data Analysis by Virtual Reality System	Plasma and Fusion Research	5	Special Issue2	S2109-1-S2109-3	2010	refereed
105	H. Miura	Influences of Short-Wave Truncations to Spectral Energy Budget in Hall MHD Turbulence	Plasma and Fusion Research	5	Special Issue 2	S2059-1-S2059-4	2010	refereed
106	R. Horiuchi, S. Usami, H. Ohtani, T. Moritaka	Magnetic Reconnection Controlled by Multi-Hierarchy Physics in an Open System	Plasma and Fusion Research	5	Special Issue 2	S2006-1-S2006-7	2010	refereed
107	S. Nishimura, Y. Narushima, S. Toda, M. Yagi, K. Itoh, S. Itoh	Forced Magnetic Reconnection in Helical Plasmas	Plasma and Fusion Research	5		040-1-040-3	2010	refereed

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108	R. Seki, Y. Matsumoto, Y. Suzuki, K. Watanabe, K. Hamamatsu, M. Itagaki	Monte Carlo Study Based on a Real Coordinate System for Tangentially Injected High-Energy Particles in the Large Helical Device	Plasma and Fusion Research	5		027-1-027-9	2010	refereed
109	H. Hasegawa, T. Sato	Improved Open Boundary Model for Plasma Particle Simulations	Plasma and Fusion Research	5		020-1-020-7	2010	refereed
110	Y. Nagashima, K. Nagaoka, K. Itoh, A. Fujisawa, M. Isobe, T. Akiyama, C. Suzuki, S. Nishimura, Y. Yoshimura, K. Matsuoka, S. Okamura, Y. Takase, A. Ejiri, S. Itoh, M. Yagi	Observation of edge Reynolds stress increase preceding an L-H transition in Compact Helical System	Plasma and Fusion Research	5		022-1-022-3	2010	refereed
111	M. Nunami, T. Watanabe, H. Sugama	Gyrokinetic Vlasov Code Including Full Three-dimensional Geometry of Experiments	Plasma and Fusion Research	5		016-1-016-8	2010	refereed
112	R. Seki, Y. Matsumoto, Y. Suzuki, K. Watanabe, K. Hamamatsu, M. Itagaki	Monte-Carlo Study Based on Real Coordinates for Perpendicularly Injected High-Energy Ions in the LHD High-Beta Plasma	Plasma and Fusion Research	5		014-1-014-3	2010	refereed
113	T. Kobayashi, S. Inagaki, H. Arakawa, K. Kamataki, Y. Nagashima, T. Yamada, S. Sugita, M. Yagi, N. Kasuya, A. Fujisawa, S. Itoh, K. Itoh	Bispectral Analysis of Density and Potential Fluctuations in a High Neutral Density Cylindrical Plasma	Plasma and Fusion Research	5	Special Issue2	S2047-1-S2047-4	2010	refereed
114	K. Uzawa, A. Ishizawa, N. Nakajima	Intrinsic Rotation of a Magnetic Island with Finite Width	Plasma and Fusion Research	5	Special Issue1	S1016-1-S1016-6	2010	refereed
115	S. Toda, K. Itoh, N. Ohyabu	Theoretical Modeling of Transport Barriers in Helical Plasmas	Plasma and Fusion Research	5	Regular Issue	011-1-011-9	2010	refereed
116	G. Kawamura, Y. Tomita, M. Kobayashi, D. Tskhakaya	1D modeling of LHD divertor plasma and hydrogen recycling	Plasma and Fusion Research	5	Special Issue	S1020-1-S1020-6	2010	refereed
117	A. Shimizu, T. Ido, M. Nishiura, S. Nakamura, H. Nakano, S. Ohshima, A. Nishizawa, M. Yokoyama, Y. Yoshimura, S. Kubo, T. Shimozuma, H. Igami, H. Takahashi, N. Tamura, I. Yamada, T. Minami, K. Narihara, T. Akiyama, T. Tokuzawa, K. Tanaka, K. Kawahata, K. Toi, M. Isobe, F. Watanabe, K. Ogawa, K. Nagaoka, K. Ikeda, M. Osakabe, K. Tsumori, Y. Takeiri, O. Kaneko, S. Kato, M. Yokota, Y. Hamada	Potential Measurement with the 6-MeV Heavy Ion Beam Probe of LHD	Plasma and Fusion Research	5	Special Issue	S1015-1-S1015-5	2010	refereed

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118	H. Nakanishi, M. Kojima, M. Ohsuna, S. Imazu, M. Nonomura, T. Yamamoto, M. Emoto, Y. Nagayama, K. Kawahata, M. Hasegawa, A. Higashijima, K. Nakamura, M. Yoshikawa	Clustered Data Storage for Multi-site Fusion Experiments	Plasma and Fusion Research	5	Special Issue	S1042-1-S1042-5	2010	refereed
119	S. Itoh, K. Itoh	A mini-max principle for drift waves and mesoscale fluctuations	Plasma Physics and Controlled Fusion	53	1	015008-1-015008-8	2010	refereed
120	R. Kanno, M. Nunami, S. Satake, H. Takamaru, M. Okamoto, N. Ohyabu	Modelling of ion energy transport in perturbed magnetic field in collisionless toroidal plasma	Plasma Physics and Controlled Fusion	52	11	115004-1-115004-26	2010	refereed
121	T. Ido, A. Shimizu, M. Nishiura, K. Nagaoka, M. Yokoyama, K. Ida, M. Yoshinuma, K. Toi, H. Nakano, S. Nakamura, F. Watanabe, S. Satake, Y. Yoshimura, M. Osakabe, K. Tanaka, T. Tokuzawa, Y. Takeiri, K. Tsumori, K. Ikeda, S. Kubo, T. Shimozuma, H. Igami, H. Takahashi, N. Tamura	Experimental study of radial electric field and electrostatic potential fluctuation in the Large Helical Device	Plasma Physics and Controlled Fusion	52	12	124025-1-124025-14	2010	refereed
122	H. Arakawa, S. Inagaki, Y. Nagashima, T. Yamada, K. Kamataki, T. Kobayashi, S. Sugita, M. Yagi, N. Kasuya, A. Fujisawa, S. Itoh, K. Itoh	Bifurcation of the plasma turbulence on LMD-U	Plasma Physics and Controlled Fusion	52	10	105009-1-105009-12	2010	refereed
123	A. Ito, N. Nakajima	Corrigendum of "Analytic high-beta tokamak equilibria with poloidal-sonic flow"	Plasma Physics and Controlled Fusion	52	7	079802-1-079802-3	2010	refereed
124	S. Inagaki, N. Tamura, K. Ida, K. Tanaka, Y. Nagayama, K. Kawahata, S. Sudo, K. Itoh, S. Itoh, A. Komori	Characterization of bifurcation induced by long distance correlation between heat flux and temperature gradient in toroidal plasmas	Plasma Physics and Controlled Fusion	52	7	075002-1-075002-8	2010	refereed
125	M. Kono, M. Skoric	Nonlinear Physics of Plasmas	Springer Series on Atomic, Optical and Plasma Physics	62		1-536	2010	refereed
126	A. Ito, N. Ohno	Special Topic Article:1. Introduction. Recent Progress of Simulation and Modeling in SOL/Divertor Plasma and Plasma Facing Material	プラズマ・核融合学会誌(Journal of Plasma and Fusion Research)	86	12	679-680	2010	unrefereed

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127	S. Saito, G. Kawamura, K. Inai	Special Topic Article: Recent Progress of Simulation and Modeling in SOL/Divertor Plasma and Plasma Facing Material 4.Simulation for Ion-Material Interaction by Binary Collision Approximation and Monte-Carlo Method(<Special Topic Article>Recent Progress of Simulation and Modeling in SOL/Divertor Plasma and Plasma Facing Material)	プラズマ・核融合学会誌(Journal of Plasma and Fusion Research)	86	12	690-693	2010	unrefereed
128	A. Ito	Special Topic Article: Recent Progress of Simulation and Modeling in SOL/Divertor Plasma and Plasma Facing Material 5. Molecular Dynamics for Plasma-Wall Interaction	プラズマ・核融合学会誌(Journal of Plasma and Fusion Research)	86	12	694-697	2010	unrefereed
129	K. Itoh, Y. Ogawa, K. Ida, H. Yamada, S. Itoh, Y. Kamada, H. Azechi, R. Kodama, K. Tanaka, A. Fukuyama, H. Fujiyama, R. Hatakeyama		プラズマ・核融合学会誌(Journal of Plasma and Fusion Research)	86	3	188-201	2010	unrefereed
130	K. Nagaoka, M. Yokoyama, M. Yoshinuma, K. Ida, Y. Takeiri	Recent progress of ion heat transport on LHD	プラズマ・核融合学会誌(Journal of Plasma and Fusion Research)	86	2	69-96	2010	unrefereed

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131	Y. Todo	Nonlinear simulations of Alfvén eigenmodes destabilized by energetic particles	AIP conference proceedings	1478		141–154	2011	unrefereed
132	N. Hirayama, A. Endo, K. Fujita, Y. Hasegawa, N. Hatano, H. Nakamura	Temperature distribution in nano-devices under a strong magnetic field	Computer Physics Communications	182	1	90–92	2011	refereed
133	T. Matsui, H. Usui, T. Moritaka, M. Nunami	MPI Parallelization of PIC Simulation with Adaptive Mesh Refinement	IEEE Conference Proceedings (by IEEE Xplore)			277–281	2011	refereed
134	H. Miura	Visualization of Three-Dimensional MHD Simulation Data to Study Fine Unstable Motions in a Helical Torus Device	IEEE Transactions on Plasma Science	39	11	3008–3009	2011	refereed
135	N. Ohno, H. Hasegawa, T. Sato	Images of Aurora Light Based on Macro–Micro–Interlocked Simulation	IEEE Transactions on Plasma Science	39	11	2708–2709	2011	refereed
136	H. Ohtani, Y. Tamura, A. Kageyama, S. Ishiguro	Scientific Visualization of Plasma Simulation Results and Device Data in Virtual-Reality Space	IEEE Transactions on Plasma Science	39	11	2472–2473	2011	refereed
137	A. Ito, A. Takayama, S. Saito, N. Ohno, S. Kajita, H. Nakamura	Molecular Dynamics Simulation of Chemical Vapor Deposition of Amorphous Carbon: Dependence on H/C Ratio of Source Gas	Japanese Journal of Applied Physics	50	1S1	01AB01-1–01AB01-6	2011	refereed
138	H. Nakamura, A. Ito, S. Saito, A. Takayama, Y. Tamura, N. Ohno, S. Kajita	Molecular Dynamics Simulation of Hydrogen Injection onto Diamond Surfaces	Japanese Journal of Applied Physics	50		01AB04-1–01AB04-4	2011	refereed
139	A. Takayama, S. Saito, A. Ito, T. Kenmotsu, H. Nakamura	Extension of Binary-Collision-Approximation-Based Simulation Applicable to Any Structured Target Material	Japanese Journal of Applied Physics	50	1	01AB03-1–01AB03-4	2011	refereed
140	S. Saito, A. Ito, H. Nakamura	Reaction between Graphene and Hydrogen under Oblique Injection	Journal of Applied Physics	110	8	084320-1–084320-9	2011	refereed
141	Y. Tamura, S. Fujiwara, T. Umetani, H. Nakamura	Bracelet-Shaped Thermal Display for Representing Numerical Data	Journal of Electronic Materials	40	5	823–829	2011	refereed
142	H. Nakamura, N. Hatano, R. Shirasaki, N. Hirayama, K. Yonemitsu	Quantum Oscillations of Thermoelectric Effects in a Pseudo-one-dimensional Electron Gas With a Spin-Orbit Interaction	Journal of Electronic Materials	40	5	601–605	2011	refereed
143	N. Hirayama, A. Endo, K. Fujita, Y. Hasegawa, N. Hatano, H. Nakamura, R. Shirasaki, K. Yonemitsu	Temperature Distribution in Two-Dimensional Electron Gases under a Strong Magnetic Field	Journal of Electronic Materials	40	5	529–532	2011	refereed
144	Y. Hiraki, T. Watanabe	Feedback instability analysis for dipole configuration with ionospheric and magnetospheric cavities	Journal of Geophysical Research – Space Physics	116	A11220	1–11	2011	refereed
145	G. Kawamura, Y. Tomita, A. Kirschner	PIC simulation of kinetic effects of plasma and consequences for physical sputtering	Journal of Nuclear Materials	415	1	S192–S195	2011	refereed
146	S. Saito, A. Ito, A. Takayama, T. Kenmotsu, H. Nakamura	Hybrid simulation between molecular dynamics and binary collision approximation codes for hydrogen injection into carbon materials	Journal of Nuclear Materials	415	1S	S208–S211	2011	refereed

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147	H. Miura, K. Araki	Local structures of homogeneous Hall MHD turbulence	Journal of Physics: Conference Series	318	7	072032-1-7	2011	unrefereed
148	H. Wang, Y. Todo	Interaction between Energetic Particles and Alfven Eigenmodes in Reversed Shear Plasmas	Journal of the Physical Society of Japan	80	9	094501-1-094501-7	2011	refereed
149	A. Ito, N. Nakajima	Equilibria of Toroidal Plasmas with Toroidal and Poloidal Flow in High-beta Reduced Magnetohydrodynamic Models	Nuclear Fusion	51	12	123006-1-123006-11	2011	refereed
150	T. Watanabe, H. Sugama, M. Nunami	Effects of Equilibrium-Scale Radial Electric Fields on Zonal Flows and Turbulence in Helical Configurations	Nuclear Fusion	51	12	123003-1-10	2011	refereed
151	H. Nakanishi, M. Ohsuna, M. Kojima, S. Imazu, M. Nonomura, T. Yamamoto, M. Emoto, M. Yoshida, C. Iwata, M. Shoji, Y. Nagayama, K. Kawahata, M. Hasegawa, A. Higashijima, K. Nakamura, Y. Ono, M. Yoshikawa, S. Urushidani	Data acquisition system for steady-state experiments at multiple sites	Nuclear Fusion	51	11	113014-6	2011	refereed
152	N. Yanagi, A. Sagara, T. Goto, S. Masuzaki, T. Mito, G. Bansal, Y. Suzuki, Y. Nagayama, K. Nishimura, S. Imagawa, O. Mitarai	Heat flux reduction by helical divertor coils in the heliotron fusion energy reactor	Nuclear Fusion	51	10	103017-1-6	2011	refereed
153	K. Nagaoka, K. Ida, M. Yoshinuma, Y. Takeiri, M. Yokoyama, S. Morita, K. Tanaka, T. Ido, A. Shimizu, N. Tamura, H. Funaba, S. Murakami, M. Goto, H. Takahashi, C. Suzuki, Y. Suzuki, K. Ikeda, M. Osakabe, K. Tsumori, H. Nakano, O. Kaneko, H. Yamada	Heat and Momentum Transport of Ion Internal Transport Barrier Plasmas on the Large Helical Device	Nuclear Fusion	51	8	083022-1-083022-7	2011	refereed
154	Y. Narushima, F. Castejón, S. Sakakibara, K. Watanabe, S. Ohdachi, Y. Suzuki, T. Estrada, F. Medina, D. López-Bruna, M. Yokoyama, M. Yoshinuma, K. Ida, S. Nishimura	Experimental study of the poloidal flow effect on magnetic island dynamics in LHD and TJ-II	Nuclear Fusion	51	8	083030	2011	refereed

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155	S. Kitajima, H. Takahashi, K. Ishii, J. Satoh, T. Ambo, M. Kanno, A. Okamoto, M. Sasao, S. Inagaki, M. Takayama, S. Masuzaki, M. Shoji, N. Ashikawa, M. Tokitani, M. Yokoyama, Y. Suzuki, T. Shimozuma, T. Ido, A. Shimizu, Y. Nagayama, T. Tokuzawa, K. Nishimura, T. Morisaki, S. Kubo, H. Kasahara, T. Muto, H. Yamada, Y. Tatematsu	Electrode Biasing Experiment in the Large Helical Device	Nuclear Fusion	51	8	083029-1-5	2011	refereed
156	T. Goto, Y. Suzuki, N. Yanagi, K. Watanabe, S. Imagawa, A. Sagara	Importance of helical pitch parameter in LHD-type heliotron reactor designs	Nuclear Fusion	51	8	083045-1-083045-6	2011	refereed
157	T. Johzaki, H. Nagatomo, A. Sunahara, H. Cai, H. Sakagami, Y. Nakao, K. Mima	Pre-plasma effects on core heating and enhancing heating efficiency by extended double cone for FIREX	Nuclear Fusion	51	7	073022-1-073022-9	2011	refereed
158	T. Ido, A. Shimizu, M. Nishiura, S. Nakamura, S. Kato, H. Nakano, Y. Yoshimura, K. Toi, K. Ida, M. Yoshinuma, S. Satake, F. Watanabe, S. Morita, M. Goto, K. Itoh, S. Kubo, T. Shimozuma, H. Igami, H. Takahashi, I. Yamada, K. Narihara	Potential fluctuation associated with the energetic-particle-induced geodesic acoustic mode in the Large Helical Device	Nuclear Fusion	51	7	073046-1-8	2011	refereed
159	K. Ichiguchi, B. Carreras	Multi-Scale MHD Analysis Incorporating Pressure Transport Equation for Beta-Increasing LHD Plasma	Nuclear Fusion	51	5	053021-1-053021-7	2011	refereed
160	Y. Hamada, T. Watari, A. Nishizawa, O. Yamagishi, K. Narihara, K. Ida, Y. Kawasumi, T. Ido, M. Kojima, K. Toi	Detection of the kinetic geodesic acoustic mode (KGAM) near the centre region of JIPPT-IIU tokamak plasmas	Nuclear Fusion	51	3	033005-1-033005-8	2011	refereed
161	P. Xanthopoulos, A. Mischchenko, P. Helander, H. Sugama, T. Watanabe	Zonal Flow Dynamics and Control of Turbulent Transport in Stellarators	Physical Review Letters	107	24	245002-1-245002-4	2011	refereed

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162	S. Inagaki, T. Tokuzawa, K. Itoh, K. Ida, S. Itoh, N. Tamura, S. Sakakibara, N. Kasuya, A. Fujisawa, S. Kubo, T. Shimozuma, T. Ido, S. Nishimura, H. Arakawa, T. Kobayashi, K. Tanaka, Y. Nagayama, K. Kawahata, S. Sudo, H. Yamada, A. Komori	Observation of long-distance radial correlation in toroidal plasma turbulence	Physical Review Letters	107	11	115001	2011	refereed
163	S. Satake, J. Park, H. Sugama, R. Kanno	Neoclassical Toroidal Viscosity Calculations in Tokamaks Using a δf Monte Carlo Simulation and Their Verifications	Physical Review Letters	107	5	055001-1-4	2011	refereed
164	M. Janvier, A. Ishizawa, J. Li, Y. Kishimoto	Role of the pressure force in the explosive dynamics of magnetic islands in double tearing modes	Physics of Plasmas	18	10	102112-1-102112-7	2011	refereed
165	H. Sugama, T. Watanabe, M. Nunami, S. Nishimura	Quasisymmetric toroidal plasmas with large mean flows	Physics of Plasmas	18	8	082505-1-082505-11	2011	refereed
166	S. Nishimura, H. Sugama, H. Maaßberg, C. Beidler, S. Murakami, Y. Nakamura, S. Hirooka	Erratum: "A convergence study for the Laguerre expansion in the moment equation method for neoclassical transport in general toroidal plasmas" [Phys. Plasmas 17, 082510 (2010)]	Physics of Plasmas	18	6	069901-1-069901-3	2011	refereed
167	S. Matsuoka, S. Satake, M. Yokoyama, A. Wakasa, S. Murakami	Neoclassical electron transport calculation by using δf Monte Carlo method	Physics of Plasmas	18	3	032511-1-032511-11	2011	refereed
168	M. Nakata, T. Watanabe, H. Sugama, W. Horton	Effects of parallel dynamics on vortex structures in electron temperature gradient driven turbulence	Physics of Plasmas	18	1	012303-1-012303-11	2011	refereed
169	A. Komori, S. Sakakibara, A. Sagara, R. Horiuchi, H. Yamada, Y. Takeiri	Recent Fusion Research in the National Institute for Fusion Science	Plasma and Fusion Research	6	Special Issue 1	2102149-1-2102149-8	2011	refereed
170	Y. Suzuki, S. Sakakibara, K. Watanabe, Y. Narushima, S. Ohdachi, S. Yamamoto, H. Okada	Study of Magnetic Island Using a 3D MHD Equilibrium Calculation Code	Plasma and Fusion Research	6		2402134-1-2402134-5	2011	refereed
171	R. Shirasaki, Y. YOSHIKAI, H. QIAN, S. Fujiwara, Y. Tamura, H. Nakamura	Dissipative Particle Dynamics Simulation of Phase Behavior in Bolaamphiphilic Solution	Plasma and Fusion Research	6		2401116-1-2401116-4	2011	refereed
172	T. Ming, S. Ohdachi, Y. Suzuki	Investigation of the Noise Effect on Tomographic Reconstructions for a Tangentially Viewing Vacuum Ultraviolet Imaging Diagnostic	Plasma and Fusion Research	6	Special Issue 1	2406120-1-2406120-5	2011	refereed
173	T. Moritaka, M. Nunami, H. Usui, T. Matsui	Full Particle-in-Cell Simulation on a Small-Scale Magnetosphere Using Uniform and Nested Grid Systems	Plasma and Fusion Research	6	Special Issue 1	2401101-1-2401101-4	2011	refereed
174	Y. Asahi, Y. Suzuki, K. Watanabe, W. Cooper	MHD equilibrium analysis with anisotropic pressure in LHD	Plasma and Fusion Research	6	Special Issue 1	2403123	2011	refereed

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175	H. Hasegawa, N. Ohno, T. Sato	Response of the magnetosphere to microscopic effects in auroral arc formation	Plasma and Fusion Research	6	Special Issue 1	2401128-1-	2011	refereed
176	T. Kobayashi, S. Inagaki, H. Arakawa, S. Oldenbürger, M. Sasaki, Y. Nagashima, T. Yamada, S. Sugita, M. Yagi, N. Kasuya, A. Fujisawa, S. Itoh, K. Itoh	Observation of Nonlinear Coupling between Low Frequency Coherent Modes and Background Turbulence in LMD-U	Plasma and Fusion Research	6	Special Issue 1	2401082-1-2401082-4	2011	refereed
177	Y. Tamura, K. Ukita, N. Mizuguchi, S. Fujiwara	Design Support System with Haptic Feedback and Real-Time Interference Function	Plasma and Fusion Research	6	Special Issue 1	2406061-1-	2011	refereed
178	A. Bierwage, Y. Todo, N. Aiba, K. Shinohara, M. Ishikawa, M. Yagi	Nonlinear Hybrid Simulations of Energetic Particle Modes in Realistic Tokamak Flux Surface Geometry	Plasma and Fusion Research	6	Special Issue	2403109-1-2403109-5	2011	refereed
179	K. Araki, H. Miura	Nonlocal Interaction of Inverse Magnetic Energy Transfer in Hall Magnetohydrodynamic Turbulence	Plasma and Fusion Research	6	1	2401132-1-01132-5	2011	refereed
180	A. Kamitani, T. Takayama, T. Itoh, H. Nakamura	Extension of Meshless Galerkin/Petrov-Galerkin Approach without Using Lagrange Multipliers	Plasma and Fusion Research	6		2401074-1-	2011	refereed
181	T. Takayama, A. Kamitani, T. Itoh, H. Nakamura	Numerical Investigation on Accuracy Improvement of Permanent Magnet Method for Measuring j_C in High-Temperature Superconducting Film	Plasma and Fusion Research	6	Special Issue 1	2401059-1-2401059-4	2011	refereed
182	T. Itoh, A. Saitoh, A. Kamitani, H. Nakamura	Efficient Evaluation of Influence Coefficients in Three-Dimensional Extended Boundary-Node Method for Potential Problems	Plasma and Fusion Research	6	Special Issue 1	2401106-1-2401106-4	2011	refereed
183	S. Fujiwara, T. Itoh, M. Hashimoto, Y. Tamura, H. Nakamura, R. Horiuchi	Molecular Dynamics Simulation of Micellar Shape Change in Amphiphilic Solution	Plasma and Fusion Research	6	Special	2401040-1-2401040-4	2011	refereed
184	A. Saitoh, T. Itoh, N. Matsui, A. Kamitani, H. Nakamura	New Implementation Method for Essential Boundary Condition to Extended Element-Free Galerkin Method: Application to Nonlinear Problem	Plasma and Fusion Research	6	Special Issue 1	2401089-1-2401089-4	2011	refereed
185	K. Saito, K. Ichiguchi, R. Ishizaki	Effect of Parallel Diffusion of Equilibrium Pressure on Interaction between Interchange Mode and Static Magnetic Island	Plasma and Fusion Research	6	Special Issue 1	2403072-1-2403072-5	2011	refereed
186	R. Kanno, S. Satake, M. Nunami	Monte Carlo Simulation Code for Solving Radial Fluid Equations in Toroidal Plasmas	Plasma and Fusion Research	6	Special Issue 1	2403066-1-	2011	refereed
187	A. Iwamoto, T. Fujimura, A. Sunahara, H. Sakagami, T. Norimatsu	Mechanical issues of FIREX target under cryogenic environment	Plasma and Fusion Research	6	Special Issue 1	2404070-1-2404070-4	2011	refereed
188	S. Maeyama, A. Ishizawa, T. Watanabe, N. Nakajima, S. Tsuji-Iio, H. Tsutsui	A Numerical Method for Parallel Particle Motions in Gyrokinetic Vlasov Simulations	Plasma and Fusion Research	6	Special Issue 1	2401028-1-2401028-5	2011	refereed
189	A. Ishizawa, T. Watanabe, N. Nakajima	Gyrokinetic Simulations of Slab Ion Temperature Gradient Turbulence with Kinetic Electrons	Plasma and Fusion Research	6	Special Issue 1	2403087-2403087	2011	refereed
190	H. Ohtani, A. Kageyama, Y. Tamura, S. Ishiguro, M. Shoji	Integrated Visualization of Simulation Results and Experimental Devices in Virtual-Realty Space	Plasma and Fusion Research	6	Special Issue 1	2406027-1-	2011	refereed

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191	R. Horiuchi	Simulation science at the National Institute for Fusion Science	Plasma and Fusion Research	6	Special Issue 1	2101055-1-	2011	refereed
192	R. Seki, H. Funaba, K. Watanabe, S. Ohdachi, Y. Suzuki, S. Sakakibara, M. Sato, M. Yokoyama, S. Murakami, A. Fukuyama, N. Nakajima	Transport Study of LHD High-beta Plasmas based on Power Balance Analysis with TASK3D Code Modules	Plasma and Fusion Research	6	Special Issue 1	2402081-1-2402081-5	2011	refereed
193	T. Kobayashi, Y. Nagashima, S. Inagaki, H. Arakawa, M. Sasaki, T. Yamada, M. Yagi, N. Kasuya, A. Fujisawa, S. Itoh, K. Itoh	Method for Estimating the Wavenumber of Standing Waves Using Three Langmuir Probes	Plasma and Fusion Research	6		1401050-1-1401050-5	2011	refereed
194	S. Inagaki, T. Tokuzawa, K. Itoh, K. Ida, S. Itoh, N. Tamura, S. Sakakibara, N. Kasuya, A. Fujisawa, S. Kubo, T. Shimozuma, T. Ido, S. Nishimura, H. Arakawa, T. Kobayashi, M. Yagi, K. Tanaka, Y. Nagayama, K. Kawahata, S. Sudo, H. Yamada, A. Komori	Long Range Temperature Fluctuation in LHD	Plasma and Fusion Research	6	Regular Issue	1402017-1-1402017-9	2011	refereed
195	S. Matsuoka, S. Satake, M. Yokoyama, A. Wakasa	Radial Electric Field Formation Including Electron Radial Drift for a Core Electron-Root Confinement (CERC) Plasma in LHD	Plasma and Fusion Research	6		1203016-1-1203016-3	2011	refereed
196	N. Kasuya, S. Nishimura, M. Yagi, K. Itoh, S. Itoh	On Detection of a Global Mode Structure in Experiments by Use of Turbulence Diagnostic Simulator	Plasma and Fusion Research	6		1403002-1-1403002-5	2011	refereed
197	M. Nunami, T. Watanabe, H. Sugama, K. Tanaka	Linear Gyrokinetic Analyses of ITG Modes and Zonal Flows in LHD with High Ion Temperature	Plasma and Fusion Research	6		1403001-1-	2011	refereed
198	S. Toda, K. Itoh	Study of electric field pulsation in helical plasmas	Plasma Physics and Controlled Fusion	53	11	115011(1)-(14)	2011	refereed
199	M. Itagaki, T. MAEDA, T. ISHIMARU, G. Okubo, K. Watanabe, R. Seki, Y. Suzuki	Three-dimensional Cauchy-condition surface method to identify the shape of the last closed magnetic surface in the Large Helical Device	Plasma Physics and Controlled Fusion	53	105007	1-17	2011	refereed
200	T. Kobayashi, S. Inagaki, S. Itoh, K. Ida, S. Oldenbürger, H. Tsuchiya, Y. Nagayama, K. Kawahata, H. Yamada, M. Sasaki, A. Fujisawa, K. Itoh	Verification of wavelet analysis for a heat pulse propagation experiment	Plasma Physics and Controlled Fusion	53	9	095012-1-12	2011	refereed
201	R. Ishizaki, N. Nakajima	Magnetohydrodynamic simulation on pellet plasmoid in torus plasmas	Plasma Physics and Controlled Fusion	53	5	054009-1-054009-14	2011	refereed
202	S. Satake, H. Sugama, R. Kanno, J. Park	Calculation of neoclassical toroidal viscosity in tokamaks with broken toroidal symmetry	Plasma Physics and Controlled Fusion	53	5	054018-1-054018-21	2011	refereed

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203	H. Sugama, T. Watanabe, M. Nunami, S. Nishimura	Momentum balance and radial electric fields in axisymmetric and nonaxisymmetric toroidal plasmas	Plasma Physics and Controlled Fusion	53	2	024004-1-024004-17	2011	refereed
204	K. Toi, K. Ogawa, M. Isobe, M. Osakabe, D. Spong, Y. Todo	Energetic-ion-driven global instabilities in stellarator/helical plasmas and comparison with tokamak plasmas	Plasma Physics and Controlled Fusion	53	2	024008	2011	refereed
205	N. Kasuya, S. Nishimura, M. Yagi, K. Itoh, S. Itoh	Heavy Ion Beam Probe Measurement in Turbulence Diagnostic Simulator	Plasma Science and Technology	13	3	326-331	2011	refereed
206	Y. Tomita, G. Kawamura, Z. Huang, Y. Pan, L. Yan	Dust Charging and Dynamics in Tokamaks	Plasma Science and Technology	13	1	11-14	2011	refereed
207	H. Usui, M. Nunami, T. Moritaka, T. Matsui, Y. Yagi	A Multi-Scale Electromagnetic Particle Code with Adaptive Mesh Refinement and Its Parallelization	Procedia Computer Science	4		2337-2343	2011	refereed
208	S. Saito, A. Takayama, A. Ito, T. Kenmotsu, H. Nakamura	How to Combine Binary Collision Approximation and Multi-body Potential for Molecular Dynamics	Progress in Nuclear Science and	2		44-50	2011	refereed
209	H. Hasegawa, N. Ohno, T.	Holistic Simulation of Auroral Arc Formation	ながれ	30	5	401-408	2011	unrefereed
210	H. Miura	Special Topic Article: Self-Organization Due to Long-Range Correlation 2.Self-Organization in Three-Dimensional Navier-Stokes System	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	87	7	430-435	2011	unrefereed
211	S. Itoh, R. Kodama, A. Fujisawa, M. Sato, K. Tanaka, R. Hatakeyama, K. Itoh		プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	87	6	371-381	2011	refereed
212	Y. Tomita, Y. Tanaka	Special Topic Article: Advances in Various Fields of "Plasma and Dust Particles" 5. Dust Research in Fusion Plasma 5.1 Modeling of Dust Charging and Dynamics in Fusion Plasma	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	87	3	149-152	2011	unrefereed
213	T. Katagiri, M. Sato	A Blocked BSS Implementation for Sparse Matrix-vector Multiplication and Its Performance Evaluation on a High Thread Parallel Environment	情報処理学会論文誌	4	3	1-8	2011	refereed
214	K. Itoh, S. Itoh	Memory of Prof. Shoichi Yoshikawa	日本物理学会誌 (BUTSURI)	66	2	144	2011	unrefereed

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215	M. Rajkovic, T. Watanabe, M. Skoric	Characterization of turbulence and transport in magnetic confinement devices	AIP conference proceedings	1445		15-33	2012	refereed
216	M. Skoric, L. Nikolic, S. Ishiguro	Attosecond Photon and Electron Pulses from Relativistic Laser Plasmas	AIP conference proceedings	1421		193-202	2012	refereed
217	M. Hashida, Y. Miyasaka, M. Shimizu, T. Ogata, H. Sakagami, S. Tokita, S. Sakabe	Mechanism of femtosecond laser nano-ablation for metals	ALT Proceedings	1		140-141	2012	unrefereed
218	S. Fujiwara, M. Hashimoto, T. Itoh, R. Horiuchi	Micellar Shape Change in Amphiphilic Solution: A Molecular Dynamics Study	Chemistry Letters	41	10	1038-1040	2012	refereed
219	S. Usami, H. Ohtani, R. Horiuchi, M. Den	Simulation of Plasma Flow Injection with Multi-Hierarchy Model Aiming Magnetic Reconnection Studies	Communications in Computational Physics	11	3	1006-1021	2012	refereed
220	S. Maeyama, A. Ishizawa, T. Watanabe, N. Nakajima, S. Tsuji-Iio, H. Tsutsui	A hybrid method of semi-Lagrangian and additive semi-implicit Runge-Kutta schemes for gyrokinetic Vlasov simulations	Computer Physics Communications	183	9	1986-1992	2012	refereed
221	Y. Tomita, G. Kawamura, M. Ueno, N. Ohno, Z. Huang, Y. Pan, L. Yan	Electric Field at a Plasma-Facing Wall for a Two-Temperature Electron Distribution	Contributions to Plasma Physics	52	5-6	484-489	2012	refereed
222	M. Ueno, N. Ohno, Y. Tomita, G. Kawamura	Conditions for the Release of a Metallic Dust Particle from a Plasma-Facing Wall	Contributions to Plasma Physics	52		478-483	2012	refereed
223	M. Emoto, M. Yoshida, C. Suzuki, Y. Suzuki, K. Ida, Y. Nagayama, T. Akiyama, K. Kawahata, K. Narihara, T. Tokuzawa, I. Yamada	Application of virtual machine technology to real-time mapping of Thomson scattering data to flux coordinates for the LHD	Fusion Engineering and Design	87	12	2076-2080	2012	refereed
224	S. Saito, A. Ito, A. Takayama, H. Nakamura	Anisotropic Bond Orientation of Amorphous Carbon by Deposition	Japanese Journal of Applied Physics	51		01AC05-1-01AC05-5	2012	refereed
225	T. Gotoh, S. Hatanaka, H. Miura	Spectral compact difference hybrid computation of passive scalar in isotropic turbulence	Journal of Computational Physics	231	21	7398-7414	2012	refereed
226	R. Shirasaki, A. Endo, N. Hatano, H. Nakamura	Thermomagnetic Effect in the Quantum Hall System	Journal of Electronic Materials	41	6	1540-1545	2012	refereed
227	N. Hirayama, A. Endo, K. Fujita, Y. Hasegawa, N. Hatano, H. Nakamura, R. Shirasaki, K. Yonemitsu	Transport-Coefficient Dependence of Current-Induced Cooling Effect in a Two-Dimensional Electron Gas	Journal of Electronic Materials	41	6	1535-1539	2012	refereed
228	T. Watanabe, H. Sugama, M. Nunami, M. Nakata	Gyrokinetic simulation studies for non-axisymmetric plasma con nement: turbulent transport and entropy transfer	Journal of Physics: Conference Series	399	1	012020-1-10	2012	refereed
229	K. Itoh, S. Itoh, S. Toda	Dual Maxwell Construction and Transport Barrier of Helical Plasmas	Journal of the Physical Society of Japan	81	12	124501-1-124501-8	2012	refereed

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230	S. Inagaki, T. Kobayashi, K. Itoh, T. Tokuzawa, S. Itoh, K. Ida, N. Tamura, N. Kasuya, A. Fujisawa, S. Kubo, T. Shimozuma, M. Yagi, K. Tanaka, Y. Nagayama, K. Kawahata, H. Yamada	Bi-coherence Analysis of Fluctuations with Long Distance Correlation in Toroidal Plasmas	Journal of the Physical Society of Japan	81	3	03450-1-03450-5	2012	refereed
231	M. Hata, H. Sakagami, A. Sunahara, T. Johzaki, H. Nagatomo	Effects of CH foam preplasma on fast ignition	Laser and Particle Beams	30	2	189-197	2012	refereed
232	H. Sakagami, K. Okada, Y. Kaseda, T. Taguchi, T.	Collisional Effects on Fast Electron Generation and Transport in Fast Ignition	Laser and Particle Beams	30	2	243-248	2012	refereed
233	H. Sakagami, A. Sunahara, T. Johzaki, H. Nagatomo	Effects of long rarefied plasma on fast electron generation for FIREX-I targets	Laser and Particle Beams	30	1	103-109	2012	refereed
234	J. Miyazawa, T. Goto, R. Sakamoto, G. Motojima, C. Suzuki, H. Funaba, T. Morisaki, S. Masuzaki, I. Yamada, S. Murakami, Y. Suzuki, M. Yokoyama, B. Peterson, H. Yamada, A. Sagara	Formularization of the confinement enhancement factor as a function of the heating profile for FFHR-d1 core plasma design	Nuclear Fusion	52	12	123007-1-10	2012	refereed
235	Y. Todo, H. Berk, B. Breizman	Saturation of a toroidal Alfvén eigenmode due to enhanced damping of nonlinear sidebands	Nuclear Fusion	52	9	094018-1-094018-8	2012	refereed
236	Y. Takemura, S. Sakakibara, Y. Narushima, M. Okamoto, K. Watanabe, Y. Suzuki, S. Ohdachi, K. Ida, M. Yoshinuma, K. Tanaka, T. Tokuzawa, K. Narihara, I. Yamada, H. Yamada	Mode locking phenomena observed near the stability boundary of the ideal interchange mode of LHD	Nuclear Fusion	52	10	102001	2012	refereed
237	Y. Hamada, T. Watari, A. Nishizawa, O. Yamagishi, K. Narihara, Y. Kawasumi, T. Ido, M. Kojima, K. Toi	Regions of kinetic geodesic acoustic modes and streamers in JIPPT-IIU tokamak plasmas	Nuclear Fusion	52	6	063023-1-11	2012	refereed
238	Y. Todo, H. Berk, B. Breizman	Simulation of Alfvén eigenmode bursts using a hybrid code for nonlinear magnetohydrodynamics and energetic particles	Nuclear Fusion	52	3	033003-1-033003-10	2012	refereed
239	M. Sasaki, K. Itoh, S. Itoh, N. Kasuya	Zonal Flows Induced by Symmetry Breaking with Existence of Geodesic Acoustic Modes	Nuclear Fusion	52	2	23009-1-14	2012	refereed

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240	S. Inagaki, N. Tamura, T. Tokuzawa, K. Ida, T. Kobayashi, T. Shimozuma, S. Kubo, H. Tsuchiya, Y. Nagayama, K. Kawahata, S. Sudo, A. Fujisawa, K. Itoh, S. Itoh	Fluctuations with long-distance correlation in quasi-stationary and transient plasmas of LHD	Nuclear Fusion	52	2	023022-1-7	2012	refereed
241	M. Skoric, L. Nikolic, L. Hadzievski, S. Ishiguro, K. Mima	Ultra-short photon pulse generation in relativistic laser-plasmas	Physica Scripta	T149		14081	2012	refereed
242	M. Skoric, L. Nikolic, L. Hadzievski, S. Ishiguro, K. Mima	Ultra-short photon pulse generation in relativistic laser-plasmas	Physica Scripta	2012	T149	014081-1-014081-4	2012	refereed
243	S. Inoue, S. Tokita, K. Otani, M. Hashida, M. Hata, H. Sakagami, T. Taguchi, S.	Autocorrelation Measurement of Fast Electron Pulses Emitted through the Interaction of Femtosecond Laser Pulses with a Solid Target	Physical Review Letters	109	185001	1月5日	2012	refereed
244	J. Baumgaertel, G. Hammett, D. Mikkelsen, M. Nunami, P. Xanthopoulos	Gyrokinetic studies of the effect of β on drift-wave stability in the National Compact Stellarator Experiment	Physics of Plasmas	19	12	122306-1-122306-9	2012	refereed
245	S. Nishimura, S. Toda, M. Yagi, Y. Narushima	Nonlinear stability of magnetic islands in a rotating helical plasma	Physics of Plasmas	19	12	122510-1-122510-15	2012	refereed
246	Y. Hiraki, T. Watanabe	Hybrid Alfvén resonant mode generation in the magnetosphere-ionosphere coupling system	Physics of Plasmas	19	10	102904-1-102904-6	2012	refereed
247	O. Yamagishi, H. Sugama	Collisionless kinetic-fluid simulation of zonal flows in non-circular tokamaks	Physics of Plasmas	19	9	092504-1-092504-10	2012	refereed
248	A. Ishizawa, F. Waelbroeck, R. Fitzpatrick, W. Horton, N. Nakajima	Magnetic island evolution in hot ion plasmas	Physics of Plasmas	19	7	072312-1-072312-13	2012	refereed
249	M. Nunami, T. Watanabe, H. Sugama, K. Tanaka	Gyrokinetic turbulent transport simulation of a high ion temperature plasma in large helical device experiment	Physics of Plasmas	19	4	042504-1-042504-7	2012	refereed
250	M. Nakata, T. Watanabe, H. Sugama	Nonlinear entropy transfer via zonal flows in gyrokinetic plasma turbulence	Physics of Plasmas	19	2	022303-1-14	2012	refereed
251	K. Saito, K. Ichiguchi, R. Ishizaki	Numerical Analysis of Resistive Interchange Mode in Equilibria Consistent with Static Magnetic Islands in a Straight Heliotron Configuration	Plasma and Fusion Research	7	Regular Issue	1403156	2012	refereed
252	T. Itoh, A. Saitoh, A. Kamitani, H. Nakamura	Implicit Function with Natural Behavior over Entire Domain	Plasma and Fusion Research	7	Special Issue 1	2406068-1-	2012	refereed
253	G. Kawamura, I. Murakami, Y. Tomita, S. Masuzaki	1D Model Study on the Effect of Impurity Radiation Cooling in LHD SOL Plasma	Plasma and Fusion Research	7	Special Issue 1	2403129-1-	2012	refereed
254	N. Mizuguchi, A. Sanpei, S. Fujita, K. Oki, H. Himura, S. Masamune, K. Ichiguchi	Modeling of Formation of Helical Structures in Reversed-Field Pinch	Plasma and Fusion Research	7	Special Issue 1	2403117-1-2403117-4	2012	refereed

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255	A. Saitoh, T. Itoh, N. Matsui, A. Kamitani, H. Nakamura	Application of Collocation Meshless Method to Eigenvalue Problem	Plasma and Fusion Research	7	Special Issue 1	2406096-1-	2012	refereed
256	S. Nishimura, S. Toda, M. Yagi, Y. Narushima	Stability of Externally Driven Magnetic Islands in a Helical Plasma	Plasma and Fusion Research	7	Special Issue 1	2403107-1-	2012	refereed
257	A. Bierwage, N. Aiba, Y. Todo, W. Deng, M. Ishikawa, G. Matsunaga, K. Shinohara, M. Yagi	Nonlinear Simulation of Energetic Particle Modes in High-Beta Tokamak Plasma	Plasma and Fusion Research	7	Special Issue 1	2403081-1-2403081-4	2012	refereed
258	K. Saito, K. Ichiguchi, R. Ishizaki	Low Beta MHD Equilibrium Including a Static Magnetic Island for Reduced MHD Equations in a Straight Heliotron Configuration	Plasma and Fusion Research	7	Regular Issue	1403070-1-1403070-	2012	refereed
259	H. Sugama, T. Watanabe, M. Nunami, S. Satake, S. Matsuoka, K. Tanaka	Kinetic Simulations of Neoclassical and Anomalous Transport Processes in Helical Systems	Plasma and Fusion Research	7	Special Issue 1	2403094-1-2403094-9	2012	refereed
260	M. Emoto, M. Yoshida, C. Suzuki, Y. Suzuki, K. Ida, Y. Nagayama, T. Akiyama, K. Kawahata, K. Narihara, T. Tokuzawa, I. Yamada	Performance Improvement in Real-Time Mapping of Thomson Scattering Data to Flux Coordinates in LHD	Plasma and Fusion Research	7	Special Issue 1	2405058-1-2405058-4	2012	refereed
261	T. Kobayashi, S. Inagaki, S. Oldenbürger, K. Kawashima, N. Ohyama, Y. Tobimatsu, H. Arakawa, M. Sasaki, Y. Nagashima, T. Yamada, S. Sugita, M. Yagi, N. Kasuya, A. Fujisawa, S. Itoh, K. Itoh	Time Evolution of Power Spectrum Density in Spontaneous Transition in Cylindrical Magnetized Plasma	Plasma and Fusion Research	7	Special Issue 1	2401054-1-2401054-5	2012	refereed
262	H. Hasegawa, S. Ishiguro	Particle Simulation of Plasma Blob Dynamics: Preliminary Results	Plasma and Fusion Research	7	Special Issue	2401060-1-	2012	refereed
263	S. Ikuno, Y. Fujita, T. Itoh, S. Nakata, H. Nakamura, A. Kamitani	Numerical Simulation of Electromagnetic Wave Propagation using Time Domain Meshless Method	Plasma and Fusion Research	7	Special Issue 1	2406044-1-2406044-4	2012	refereed
264	K. Saito, K. Ichiguchi, R. Ishizaki	Numerical Calculation of MHD Equilibria Including Static Magnetic Islands in a Straight Heliotron Configuration by Means of a Field Line Tracing Method	Plasma and Fusion Research	7	Special Issue	2403032	2012	refereed
265	M. Isaev, K. Watanabe, S. Satake, Y. Nakamura, W. Cooper	Bootstrap Current Simulations with Experimental LHD Plasma Density and Temperature Profiles, Energy Scattering and Finite OrbitWidth	Plasma and Fusion Research	7	1403077	1403077-1-1403077-7	2012	refereed
266	A. Kamitani, T. Takayama, A. Saitoh, H. Nakamura	Accurate and Stable Numerical Method for Analyzing Shielding Current Density in High-Temperature Superconducting Film Containing Cracks	Plasma and Fusion Research	7	Special Issue 1	2405024-1-2405024-4	2012	refereed
267	T. Takayama, A. Kamitani, A. Saitoh, H. Nakamura	Numerical Investigation on Accuracy and Resolution of Contactless Methods for Measuring jC in High-Temperature Superconducting Film: Inductive Method and Permanent Magnet Method	Plasma and Fusion Research	7	Special Issue 1	2405017	2012	refereed

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268	M. Yokoyama, A. Wakasa, R. Seki, M. Sato, S. Murakami, C. Suzuki, Y. Nakamura, A. Fukuyama	Development of Integrated Transport Code, TASK3D, and Its Applications to LHD Experiment	Plasma and Fusion Research	7	Special Issue 1	2403011_1-2403011_4	2012	refereed
269	M. Yokoyama, A. Wakasa, R. Seki, M. Sato, S. Murakami, C. Suzuki, Y. Nakamura, A. Fukuyama	Development of Integrated Transport Code, TASK3D, and Its Applications to LHD Experiment	Plasma and Fusion Research	7	Special Issue 1	2403011-1-2403011-4	2012	refereed
270	N. Ohno, H. Ohtani, D. Matsuoka, R. Horiuchi	Visualization of Particle Trajectories in Time-Varying Electromagnetic Fields by CAVE-Type Virtual Reality System	Plasma and Fusion Research	7		1401001-1-6	2012	refereed
271	M. Itagaki, G. Okubo, M. Akazawa, Y. Matsumoto, K. Watanabe, R. Seki, Y. Suzuki	Use of a twisted 3D Cauchy condition surface to reconstruct the last closed magnetic surface in a non-axisymmetric fusion plasma	Plasma Physics and Controlled Fusion	54	12	125003-1-18	2012	refereed
272	T. Kobayashi, S. Inagaki, S. Itoh, K. Itoh, S. Oldenburger, A. Fujisawa, Y. Nagashima, K. Ida, H. Tsuchiya, Y. Nagayama, K. Kawahata, H. Yamada	Self-nonlinear coupling of long-range temperature fluctuation in Toroidal plasma	Plasma Physics and Controlled Fusion	54	11	115004-1-9	2012	refereed
273	K. Itoh, S. Itoh, S. Inagaki, T. Kobayashi, A. Fujisawa, Y. Nagashima, S. Oldenbürger, K. Ida, T. Tokuzawa, Y. Nagayama, K. Kawahata, H. Yamada	On influences of long-range fluctuations on transport in Large Helical Device plasmas	Plasma Physics and Controlled Fusion	54	9	95016	2012	refereed
274	T. Takahashi, T. Kanki, N. Mizuguchi	Commentary:Progress of Theory and Simulation Research on High-Beta Self-Organized Plasmas	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	88	8	409-417	2012	unrefereed
275	Y. Torikai, G. Kawamura	Report: 20th International Conference on Plasma Surface Interactions in Controlled Fusion Devices	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	88	8	462-462	2012	unrefereed
276	N. Nakajima, K. Yamazaki	Special Topic Articles: Present Status of 3-Dimensional MHD Research in Tokamaks and Contribution from Other Confinement	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	88	3	153-157	2012	unrefereed

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277	M. Kobayashi, Y. Feng, I. Yamada, H. Hayashi, G. Kawamura	Benchmark of Monte Carlo scheme of EMC3 dealing with non-uniform cross-field transport coefficients and implementation in LHD	Contributions to Plasma Physics	54	4-6	383-387	2013	refereed
278	H. Nagatomo, T. Johzaki, A. Sunahara, H. Sakagami, T. Yanagawa, K. Mima	Optimum design of imploded core plasma for effective fast ignition at GXII	EPJ Web of Conferences	59	3007	1-4	2013	refereed
279	T. Johzaki, A. Sunahara, S. Fujioka, H. Nagatomo, H. Sakagami, K. Mima	Fast electron beam guiding for effective core heating	EPJ Web of Conferences	59		03010-p.1-03010-p.5	2013	refereed
280	T. Yanagawa, H. Sakagami, H. Nagatomo	Three-dimensional simulations of asymmetric implosion for cone-guided targets	EPJ Web of Conferences	59		03008-p.1-03008-p.4	2013	refereed
281	M. Hata, H. Sakagami, T. Johzaki, H. Nagatomo	EFFECTS OF LASER TEMPORAL PROFILE ON FAST ELECTRON CHARACTERISTICS	EPJ Web of Conferences	59	17004	17004-p.1-17004-p.4	2013	refereed
282	H. Sakagami, T. Johzaki, T. Taguchi, K. Mima	Suppression effects of Weibel instability for fast electron divergence	EPJ Web of Conferences	59	17016	1-4	2013	refereed
283	A. Kageyama, N. Ohno, S. Kawahara, K. Kashiyama, H. Ohtani	Immersive VR Visualizations by VFIVE Part 2: Applications	International Journal of Modeling, Simulation, and Scientific Computing	4	supp01	1340004-1-16	2013	refereed
284	T. Sugimura, H. Sakagami	Oscillationless Explicit Method on Overset Grid for Advective Equation	JAMSTEC Report of Research and Development	16		1-11	2013	refereed
285	N. Kashima, H. Nakamura, A. Takayama, Y. Tamura, S. Kubo	Finite-Difference Time-Domain Simulation on Transmission of Millimeter Waves through Miter Bends	Japanese Journal of Applied Physics	52	11	11ND02-1-11ND02-2	2013	refereed
286	A. Takayama, A. Ito, S. Saito, N. Ohno, H. Nakamura	First-Principles Investigation on Trapping of Multiple Helium Atoms within a Tungsten Monovacancy	Japanese Journal of Applied Physics	52	2	01AL03-1-01AL03-4	2013	refereed
287	A. Ito, A. Takayama, S. Saito, H. Nakamura	Formation and Classification of Amorphous Carbon by Molecular Dynamics Simulation	Japanese Journal of Applied Physics	52	1S	01AL04-1-01AL04-7	2013	refereed
288	S. Saito, A. Ito, A. Takayama, H. Nakamura	Structural Change of Single-Crystalline Graphite under Plasma Irradiation	Japanese Journal of Applied Physics	52	1	01AL02-1-01AL02-6	2013	refereed
289	N. Hirayama, A. Endo, K. Fujita, Y. Hasegawa, N. Hatano, H. Nakamura, R. Shirasaki, K. Yonemitsu	Current-induced cooling phenomenon in a two-dimensional electron gas under a magnetic field	Journal of Low Temperature Physics	172	1-2	132-153	2013	refereed
290	S. Masuzaki, M. Kobayashi, T. Akiyama, N. Ohno, T. Morisaki, M. Shoji, M. Tokitani, H. Tanaka, B. Peterson, S. Yoshimura, K. Narihara, R. Yasuhara, A. Murakami, J. Miyazawa, T. Murase, T. Kobuchi, H. Yonezu, G. Kawamura, I. Murakami, Y. Takeiri, H. Yamada, A. Komori	Divertor heat and particle control experiments on the large helical device	Journal of Nuclear Materials	438	Supplement	S133-S138	2013	refereed

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291	S. Fujiwara, M. Hashimoto, T. Itoh, H. Nakamura, Y. Tamura	Shape transition of micelles in amphiphilic solution: A molecular dynamics study	Journal of Physics: Conference Series	454		012024-1-012024-4	2013	refereed
292	H. Ohtani, K. Hagita, A. Ito, T. Kato, T. Saitoh, T. Takeda	Irreversible data compression concepts with polynomial fitting in time-order of particle trajectory for visualization of huge particle system	Journal of Physics: Conference Series	454	1	012078-1-11	2013	refereed
293	M. Skoric, L. Nikolic, S. Ishiguro	Self-organization and control in stimulated Raman backscattering	Journal of Plasma Physics	79	6	1003-1006	2013	refereed
294	A. Ito, N. Nakajima	Analytic Equilibria of High-Beta Tokamaks with Toroidal and Poloidal Flows and Pressure Anisotropy Associated with Parallel Heat Flux	Journal of the Physical Society of Japan	82	6	064502-1-064502-13	2013	refereed
295	M. Hata, H. Sakagami, T. Johzaki, H. Nagatomo	Effects of laser profiles on fast electron generation under the same laser energy	Laser and Particle Beams	31		371-377	2013	refereed
296	K. Ida, S. Inagaki, Y. Suzuki, S. Sakakibara, T. Kobayashi, K. Itoh, H. Tsuchiya, C. Suzuki, M. Yoshinuma, Y. Narushima, M. Yokoyama, A. Shimizu, S. Itoh	Topology bifurcation of magnetic flux surface in plasmas	New Journal of Physics	15		13061	2013	refereed
297	T. Ozaki, M. Koga, H. Shiraga, H. Sakagami	Hot electron spectra in Gekko XII and LFEX laser	NIFS-PROC	94		38-42	2013	unrefereed
298	S. Inagaki, T. Tokuzawa, N. Tamura, S. Itoh, T. Kobayashi, K. Ida, T. Shimozuma, S. Kubo, K. Tanaka, T. Ido, A. Shimizu, H. Tsuchiya, N. Kasuya, Y. Nagayama, K. Kawahata, S. Sudo, H. Yamada, A. Fujisawa, K. Itoh	How is turbulence intensity determined by macroscopic variables in a toroidal plasma?	Nuclear Fusion	53	11	113006-1-113006-9	2013	refereed
299	S. Satake, J. Park, H. Sugama, R. Kanno	Simulation studies of the effect of E × B rotation on neoclassical toroidal viscosity in tokamaks with small magnetic perturbations	Nuclear Fusion	53	11	113033-1-10	2013	refereed

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300	M. Jakubowski, P. Drewelow, S. Masuzaki, K. Tanaka, T. Pedersen, T. Akiyama, S. Bozhenkov, A. Dinklage, M. Kobayashi, Y. Narushima, S. Sakakibara, Y. Suzuki, R. Wolf, H. Yamada	Influence of the resonant magnetic perturbations on transport in the Large Helical Device	Nuclear Fusion	53	11	113012-1-9	2013	refereed
301	O. Kaneko, H. Yamada, S. Inagaki, M. Jakubowski, S. Kajita, S. Kitajima, M. Kobayashi, K. Koga, T. Morisaki, S. Morita, T. Muto, S. Sakakibara, Y. Suzuki, H. Takahashi, K. Tanaka, K. Toi, Y. Yoshimura, T. Akiyama, Y. Asahi, N. Ashikawa, H. Chikaraishi, W. Cooper, D. Darrow, E. Drapiko, P. Drewelow, X. Du, A. Ejiri, M. Emoto, T. Evans, N. Ezumi, K. Fujii, T. Fukuda, H. Funaba, M. Furukawa, D. Gates, M. Goto, T. Goto, W. Guttenfelder, S. Hamaguchi, M. Hasuo, T. Hino, Y. Hirooka, K. Ichiguchi, K. Ida, H. Idei, T. Ido, H. Igami, K. Ikeda, S. Imagawa, T. Imai, M. Isobe, M. Itagaki, T. Ito, K. Itoh, S. Itoh, A. Iwamoto, K. Kamiya, T. Kariya, H. Kasahara, N. Kasuya, D. Kato, T. Kato, K. Kawahata, F. Koike, S. Kubo, R. Kumazawa, D. Kuwahara, S. Lazerson, H. Lee, S. Masuzaki, S. Matsuoka, H. Matsuura, A. Matsuyama, C. Michael, D. Mikkelsen, O. Mitarai, T. Mito, J. Miyazawa, G. Motojima, K. Mukai, A. Murakami, I. Murakami, S. Murakami, T. Muroga, S. Muto, K. Nagaoka, K. Nagasaki, Y. Nagayama, N. Nakajima, H. Nakamura, Y.	Extension of operation regimes and investigation of three-dimensional currentless plasmas in the Large Helical Device	Nuclear Fusion	53	10	104015-1-11	2013	refereed

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302	A. Iwamoto, T. Fujimura, M. Nakai, T. Norimatsu, H. Sakagami, H. Shiraga, H. Azechi	FIREX foam cryogenic target development: residual void reduction and estimation with solid hydrogen refractive index measurements –	Nuclear Fusion	53	8	083009-1-8	2013	refereed
303	A. Bierwage, K. Shinohara, N. Aiba, Y. Todo	Role of convective amplification of n = 1 energetic particle modes for N-NB ion dynamics in JT-60U	Nuclear Fusion	53	7	73007	2013	refereed
304	S. Kitajima, H. Takahashi, K. Ishii, Y. Sato, M. Kanno, J. Tachibana, A. Okamoto, M. Sasao, S. Inagaki, M. Takayama, S. Masuzaki, M. Shoji, N. Ashikawa, M. Tokitani, M. Yokoyama, Y. Suzuki, S. Satake, T. Ido, A. Shimizu, C. Suzuki, Y. Nagayama, T. Tokuzawa, K. Nishimura, T. Morisaki	Transition of Poloidal Viscosity by Electrode Biasing in the Large Helical Device	Nuclear Fusion	53	7	073014-1-6	2013	refereed
305	H. Takahashi, M. Osakabe, K. Nagaoka, S. Murakami, I. Yamada, Y. Takeiri, M. Yokoyama, H. Lee, K. Ida, R. Seki, C. Suzuki, M. Yoshinuma, T. Ido, A. Shimizu, M. Goto, S. Morita, T. Shimozuma, S. Kubo, S. Satake, S. Matsuoka, N. Tamura, H. Tsuchiya, K. Tanaka, M. Nunami, A. Wakasa, K. Tsumori, K. Ikeda, H. Nakano, M. Kisaki, Y. Yoshimura, M. Nishiura, H. Igami, T. Seki, H. Kasahara, K. Saito, R. Kumazawa, S. Muto, K. Narihara, T. Muto, O. Kaneko, H. Yamada	Extension of the operational regime in high-temperature plasmas and the dynamic-transport characteristics in the LHD	Nuclear Fusion	53	7	073034-1-7	2013	refereed
306	Y. Suzuki, K. Ida, K. Kamiya, M. Yoshinuma, S. Sakakibara, K. Watanabe, H. Yamada	3D plasma response to magnetic field structure in the Large Helical Device	Nuclear Fusion	53	7	073045-1-073045-5	2013	refereed
307	H. Nagatomo, T. Johzaki, A. Sunahara, H. Sakagami, K. Mima, H. Shiraga, H. Azechi	Computational study of strong magnetic field generation in a nonspherical, cone-guided implosion	Nuclear Fusion	53	6	063018-1-4	2013	refereed

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308	A. Dinklage, M. Yokoyama, K. Tanaka, J. Velasco, D. Lopez-Bruna, C. Beidler, S. Satake, E. Ascasibar, J. Arevalo, J. Baldzuhn, Y. Feng, D. Gates, J. Geiger, K. Ida, M. Jakubowski, A. Lopez-Fraguas, H. Maassberg, J. Miyazawa, T. Morisaki, S. Murakami, N. Pablant, M. Kobayashi, R. Seki, C. Suzuki, Y. Suzuki, Y. Turkin, A. Wakasa, R. Wolf, H. Yamada, M. Yoshinuma	Inter-machine validation study of neoclassical transport modelling in medium- to high-density stellarator-heliotron plasmas	Nuclear Fusion	53	6	063022-1-8	2013	refereed
309	R. Seki, K. Watanabe, H. Funaba, Y. Suzuki, Y. Matsumoto, K. Hamamatsu, S. Sakakibara, S. Ohdachi	Effect of re-entering fast ions on NBI heating power in high-beta plasmas of the Large Helical Device	Nuclear Fusion	53	6	063016-1-11	2013	refereed
310	A. Ishizawa, S. Maeyama, T. Watanabe, H. Sugama, N. Nakajima	Gyrokinetic turbulence simulations of high-beta tokamak and helical plasmas with full-kinetic and hybrid models	Nuclear Fusion	53	5	053007-1-13	2013	refereed
311	S. Sakakibara, Y. Narushima, Y. Takemura, M. Okamoto, K. Watanabe, Y. Suzuki, S. Ohdachi, K. Ida, M. Yoshinuma, K. Tanaka, T. Tokuzawa, K. Narihara, I. Yamada, H. Yamada	Response of MHD Stability to Resonant Magnetic Perturbation in the Large Helical Device	Nuclear Fusion	53	4	043010-1-7	2013	refereed
312	J. Dong, Y. Shi, N. Tamura, H. Jhang, T. Watanabe, X. Ding	APTWG: 2nd Asia-Pacific Transport Working Group Meeting	Nuclear Fusion	53	2	027001-1-027001-11	2013	refereed
313	K. Kamiya, K. Ida, M. Yoshinuma, C. Suzuki, Y. Suzuki, M. Yokoyama	Characterization of edge radial electric field structures in the Large Helical Device and their viability for determining the location of the plasma	Nuclear Fusion	53	1	013003-1-9	2013	refereed
314	M. Nakata, Y. Idomura	Plasma size and collisionality scaling of ion temperature gradient driven turbulence	Nuclear Fusion	53		113039	2013	refereed
315	T. Kobayashi, K. Itoh, T. Ido, K. Kamiya, S. Itoh, Y. Miura, Y. Nagashima, A. Fujisawa, S. Inagaki, K. Ida, K. Hoshino	Spatiotemporal Structures of Edge Limit-Cycle Oscillation before L-to-H Transition in the JFT-2M Tokamak	Physical Review Letters	111		35002-1-035002-5	2013	refereed
316	K. Ida, J. Lee, K. Nagaoka, M. Osakabe, C. Suzuki, M. Yoshinuma, R. Seki, M. Yokoyama, T. Akiyama	Reversal of Intrinsic Torque Associated with the Formation of an Internal Transport Barrier	Physical Review Letters	111	5	55001	2013	refereed

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317	H. Wang, Y. Todo, C. Kim	Hole–clump pair creation in the evolution of energetic–particle–driven geodesic acoustic modes	Physical Review Letters	110	15	155006–1–155006–5	2013	refereed
318	A. Ishizawa, F. Waelbroeck	Magnetic island evolution in the presence of ion–temperature gradient–driven turbulence	Physics of Plasmas	20	12	122301–1–122301–12	2013	refereed
319	A. Ishizawa, T. Watanabe	Reversible collisionless magnetic reconnection	Physics of Plasmas	20	10	102116–1–102116–10	2013	refereed
320	T. Yanagawa, H. Sakagami, H. Nagatomo	Simulation analysis of the effects of an initial cone position and opening angle on a cone–guided implosion	Physics of Plasmas	20	10	102703–1–102703–7	2013	refereed
321	M. Nunami, T. Watanabe, H. Sugama	A reduced model for ion temperature gradient turbulent transport in helical plasmas	Physics of Plasmas	20	9	092307–1–092307–6	2013	refereed
322	M. Toida, Y. Aota	Finite beta effects on low– and high–frequency magnetosonic waves in a two–ion–species plasma	Physics of Plasmas	20		82301	2013	refereed
323	S. Usami, R. Horiuchi, H. Ohtani, M. Den	Development of Multi–Hierarchy Simulation Model with Non–Uniform Space Grids for Collisionless Driven Reconnection	Physics of Plasmas	20	6	61208	2013	refereed
324	K. Nagaoka, K. Ida, M. Yoshinuma, Y. Suzuki, K. Kamiya, S. Satake, K. Tanaka, M. Yokoyama, S. Murakami, M. Osakabe, H. Takahashi, R. Seki, C. Suzuki, Y. Narushima, H. Nakano, M. Kisaki, K. Ikeda, K. Tsumori, Y. Takeiri, O. Kaneko, H. Yamada	3–D effects on viscosity and generation of toroidal and poloidal flows in LHD	Physics of Plasmas	20	5	056116–1–056116–6	2013	refereed
325	M. Hata, H. Sakagami, A. Das	Kinetic effects on robustness of electron magnetohydrodynamic structures	Physics of Plasmas	20	4	042303–1–042303–6	2013	refereed
326	H. Sugama, T. Watanabe, M. Nunami	Conservation of energy and momentum in nonrelativistic plasmas	Physics of Plasmas	20	2	024503–1–024503–4	2013	refereed
327	Y. Asahi, Y. Suzuki, K. Watanabe, W. Cooper	Development of an Identification Method of Pressure Anisotropy Based on Equilibrium Analysis and	Physics of Plasmas	20	2	022503–1–022503–7	2013	refereed
328	H. Wang, Y. Todo	Linear Properties of Energetic Particle Driven Geodesic Acoustic Mode	Physics of Plasmas	20	1	012506–1–012506–8	2013	refereed
329	K. Itoh, S. Itoh, A. Fujisawa	An Assessment of Limit Cycle Oscillation Dynamics Prior to L–H Transition	Plasma and Fusion Research	8		1102168–1–11	2013	refereed
330	S. Inagaki, K. Itoh, T. Yamada, S. Itoh, T. Tokuzawa, A. Fujisawa, N. Kasuya, M. Sasaki, Y. Nagashima, H. Arakawa	Measurement of Dynamical Density Profiles Using a Microwave Frequency Comb Reflectometer	Plasma and Fusion Research	8	Regular Issue	1201171–1–1201171–2	2013	refereed

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331	S. Inagaki, T. Tokuzawa, T. Kobayashi, S. Itoh, K. Itoh, K. Ida, S. Kubo, T. Shimozuma, N. Tamura, A. Fujisawa, N. Kasuya, H. Tsuchiya, Y. Nagayama, K. Kawahata, H. Yamada, A. Komori	New Method of Analysis for Dynamical Transport	Plasma and Fusion Research	8	Regular Issue	1202172-1-1202172-2	2013	refereed
332	S. Inagaki, S. Itoh, K. Itoh, N. Kasuya, T. Kobayashi, A. Fujisawa, T. Tokuzawa, K. Ida, S. Kubo, T. Shimozuma, N. Tamura, H. Tsuchiya, Y. Nagashima, K. Kawahata, H. Yamada, A. Komori	Higher Harmonics in a Perturbative Transport Experiment	Plasma and Fusion Research	8	Regular Issue	1202173	2013	refereed
333	H. Usui, Y. Yagi, M. Matsumoto, M. Nunami	Development of Parallelized AMR-PIC Plasma Simulation Code with Dynamic Domain Decomposition	Plasma and Fusion Research	8	Special Issue 1	2401149	2013	refereed
334	M. Itagaki, K. Ishimaru, Y. Matsumoto, K. Watanabe, R. Seki, Y. Suzuki	Improved three-dimensional CCS method analysis for the reconstruction of the peripheral magnetic field structure in a finite beta helical plasma	Plasma and Fusion Research	8	Regular Issue	1402134-1-1402134-14	2013	refereed
335	P. Drewelow, S. Masuzaki, S. Bozhenkov, Y. Feng, M. Jakubowski, Y. Suzuki, R. Wolf, H. Yamada	Comparison of Observed Divertor Heat Flux and Modeling Results at LHD	Plasma and Fusion Research	8	Special Issue 1	2402126-1-2402126-4	2013	refereed
336	K. Tanaka, M. Jakubowski, A. Dinklage, Y. Suzuki, M. Goto, T. Morisaki, S. Sakakibara, Y. Narushima, T. Akiyama, T. Tokuzawa, K. Kawahata, R. Yasuhara, I. Yamada, S. Masuzaki, M. Yoshinuma, K. Ida, L. Vyacheslavov, C. Michael, D. Mikkelsen, T. Evans	Effects of Resonant Magnetic Perturbation on Particle Transport in LHD	Plasma and Fusion Research	8	Special Issue 1	2402141-1-2402141-8	2013	refereed
337	Y. Takemura, S. Sakakibara, K. Watanabe, K. Ichiguchi, K. Ida, Y. Suzuki, S. Ohdachi, Y. Narushima, I. Yamada, K. Tanaka, H. Yamada	Rotation of Interchange Instability in the Large Helical Device	Plasma and Fusion Research	8	Regular Issue	1402123-1-1402123-6	2013	refereed
338	A. Shimizu, T. Ido, M. Nishiura, R. Makino, M. Yokoyama, H. Takahashi, H. Igami, Y. Yoshimura, S. Kubo, T. Shimozuma, N. Tamura	Bifurcation-like behavior of electrostatic potential in LHD	Plasma and Fusion Research	8	Special Issue 1	2402122-1-2402122-5	2013	refereed

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339	T. Ozaki, H. Shiraga, Y. Arikawa, S. Fujioka, H. Sakagami, Z. Zhang, A. Sunahara, H. Nagatomo, T. Johzaki, T. Namimoto, M. Taga, S. Kojima, Y. Abe, K. Ishihara, T. Nagai, S. Sakata, S. Hattori, Y. Sakawa, H. Nishimura, H. Azechi	Hot Electron Spectra in Plain, Cone and Integrated Targets for FIREX-I using Electron Spectrometer	Plasma and Fusion Research	8	Special Issue 1	2404125-1-2404125-4	2013	refereed
340	T. Itoh, Y. Fujita, S. Ikuno, H. Nakamura	Investigation of Numerical Stability of Electromagnetic Wave Propagation Simulation using Meshless Time-Domain Method	Plasma and Fusion Research	8	Special Issue 1	2401101-1-2401101-5	2013	refereed
341	R. Seki, M. Sato, K. Watanabe, H. Funaba, Y. Suzuki, S. Sakakibara, A. Fukuyama, S. Murakami, N. Nakajima	Development of Transport Model in Reactor Plasmas based on LHD Experiment Scaling	Plasma and Fusion Research	8	Special Issue 1	2403089-1-2403089-5	2013	refereed
342	M. Sasaki, N. Kasuya, M. Yagi, K. Itoh, Y. Nagashima, S. Inagaki, S. Itoh	Statistical Analyses of Turbulent Particle and Momentum Fluxes in a Cylindrical Magnetized Plasma	Plasma and Fusion Research	8	Special Issue 1	2401113-1-2401113-5	2013	refereed
343	Y. Miwa, N. Kasuya, M. Sasaki, S. Inagaki, K. Itoh, M. Yagi, A. Fujisawa, Y. Nagashima, M. Lesur, T. Kobayashi, S. Yamada, T. Yamashita, S. Otsubo, S. Kakigawa, T. Mitsuzono, H. Fujino, S. Itoh	Evaluation of Excitation Conditions of ITG Modes in the PANTA	Plasma and Fusion Research	8	Special Issue 1	2403133-1-2403133-5	2013	refereed
344	N. Kasuya, S. Sugita, M. Sasaki, S. Inagaki, M. Yagi, K. Itoh, S. Itoh	Evaluation of Spatial Variation of Nonlinear Energy Transfer by Use of Turbulence Diagnostic Simulator	Plasma and Fusion Research	8	Special Issue 1	2403070-1-2403070-5	2013	refereed
345	S. Nishimura, Y. Todo, D. Spong, Y. Suzuki, N. Nakajima	Simulation Study of Alfvén-Eigenmode-Induced Energetic Ion Transport in LHD	Plasma and Fusion Research	8	Special Issue 1	2403090-1-2403090-6	2013	refereed
346	Y. Fujita, T. Itoh, H. Nakamura, S. Ikuno	Three-Dimensional Analysis of Electromagnetic Wave Propagation using Meshless Time Domain Method	Plasma and Fusion Research	8	Special Issue 1	2401061-1-2401061-4	2013	refereed
347	S. Matsuoka, S. Satake, H. Takahashi, A. Wakasa, M. Yokoyama, T. Ido, A. Shimizu, T. Shimozuma, S. Murakami	Formation of electron-root radial electric field and its effect on thermal transport in LHD high Te plasma	Plasma and Fusion Research	8	Regular Issue	1403039-1-1403039-7	2013	refereed
348	T. Takayama, A. Kamitani, H. Nakamura	Numerical Investigations on Detectability of Crack by Contactless jC-Measurement Method	Plasma and Fusion Research	8	Special Issue 1	2401025-1-2401025-4	2013	refereed
349	Y. Tomita, G. Kawamura, Z. Huang, Y. Pan, L. Yan	Secondary Electron Emission from a Negatively Charged Spherical Dust Particle by Electron	Plasma and Fusion Research	8	Special Issue 1	2401028-1-2401028-4	2013	refereed
350	M. Nunami, T. Watanabe, H. Sugama	Relation among ITG Turbulence, Zonal Flows and Transport in Helical Plasmas	Plasma and Fusion Research	8	Regular Issue	1203019-1-1203019-3	2013	refereed

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351	M. Yokoyama, C. Suzuki, R. Seki, M. Osakabe, M. Yoshinuma, M. Sato, A. Wakasa, S. Murakami, A. Fukuyama, Y. Suzuki, K. Ida, H. Lee	Development of Integrated Transport Analysis Suite for LHD Plasmas Towards Transport Model Validation and Increased Predictability	Plasma and Fusion Research	8	Special Issue 1	2403016-1-2403016-4	2013	refereed
352	M. Sasaki, K. Itoh, N. Kasuya, K. Hallatschek, S. Itoh	On a Nonlinear Dispersion Effect of Geodesic Acoustic Modes	Plasma and Fusion Research	8	Regular Issue	1403010-1-1403010-6	2013	refereed
353	S. Nishimura, Y. Todo, D. Spong, Y. Suzuki, N. Nakajima	Simulation Study of Alfven-Eigenmode-Induced Energetic Ion Transport in LHD	Plasma and Fusion Research	8		2403090	2013	refereed
354	S. Inagaki, T. Tokuzawa, T. Kobayashi, S. Itoh, K. Itoh, K. Ida, S. Kubo, T. Shimozuma, N. Tamura, A. Fujisawa, N. Kasuya, H. Tsuchiya, Y. Nagayama, K. Kawahata, H. Yamada, A. Komori	New Analysis Method of Dynamical Transport	Plasma and Fusion Research	8	Regular Issue		2013	refereed
355	Y. Suzuki, K. Ida, K. Kamiya, M. Yoshinuma, H. Tsuchiya, S. Inagaki, S. Sakakibara, K. Watanabe, Y. Narushima, S. Ohdachi, I. Yamada, R. Yasuhara, K. Tanaka, T. Akiyama, H. Yamada	Investigation of radial electric field in the edge region and magnetic field structure in the Large Helical Device	Plasma Physics and Controlled Fusion	55	12	124042-1-124042-8	2013	refereed
356	R. Kanno, M. Nunami, S. Satake, H. Takamaru, M. Okamoto	Dependence of radial thermal diffusivity on parameters of toroidal plasma affected by resonant magnetic perturbations	Plasma Physics and Controlled Fusion	55	6	65005	2013	refereed
357	S. Lazerson, S. Sakakibara, Y. Suzuki	A Magnetic Diagnostic Code for 3D Fusion Equilibria	Plasma Physics and Controlled Fusion	55	2	025014-1-025014-8	2013	refereed
358	H. Miura, K. Araki	Coarse-graining study of homogeneous and isotropic Hall magnetohydrodynamics turbulence	Plasma Physics and Controlled Fusion	55	1	014012-1-4	2013	refereed
359	T. Watanabe, H. Sugama, M. Nunami, K. Tanaka, M. Nakata	Gyrokinetic simulations of entropy transfer in high ion temperature LHD plasmas	Plasma Physics and Controlled Fusion	55	1	014017-1-6	2013	refereed
360	S. Sakakibara, Y. Suzuki, Y. Narushima, K. Watanabe, Y. Takemura, S. Ohdachi, K. Ida, M. Yoshinuma, K. Narihara, I. Yamada, K. Tanaka, T. Tokuzawa, H. Yamada	Modification of the magnetic field structure of high-beta plasmas with a perturbation field in the Large Helical Device	Plasma Physics and Controlled Fusion	55	1	014014-1-6	2013	refereed
361	H. Lee, K. Ida, M. Osakabe, M. Yokoyama, C. Suzuki, K. Nagaoka, R. Seki, M. Yoshinuma, N. Tamura	Dynamic transport study of heat and momentum transport in a plasma with improved ion confinement in the Large Helical Device	Plasma Physics and Controlled Fusion	55	1	014011-1-5	2013	refereed
362	K. Ichiguchi, S. Sakakibara, S. Ohdachi, B. Carreras	Numerical magnetohydrodynamic analysis of Large Helical Device plasmas with magnetic axis swing	Plasma Physics and Controlled Fusion	55	1	014009-1-4	2013	refereed

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363	R. Horiuchi, M. Den, T. Tanaka, H. Ohtani, S. Usami	Macro- and microphysics of magnetic reconnection in a multi-hierarchy open system	Plasma Physics and Controlled Fusion	55	1	014008-1-7	2013	refereed
364	S. Nishimura, S. Toda, Y. Narushima, M. Yagi	Influence of resonant magnetic perturbation on a rotating helical plasma	Plasma Physics and Controlled Fusion	55	1	014013-1-5	2013	refereed
365	C. Suzuki, K. Ida, Y. Suzuki, M. Yoshida, M. Emoto, M. Yokoyama	Development and application of real-time magnetic coordinate mapping system in the Large Helical Device	Plasma Physics and Controlled Fusion	55	1	014016-1-7	2013	refereed
366	S. Usami, S. Zenitani	Special Topic Articles:Overview and Prospect – Frontier Researches in Magnetic Reconnection – 5. Problems and Future of Reconnection Research 5.1 Problems and Future of Simulation studies	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	12	861-863	2013	unrefereed
367	Y. Ono, R. Matsumoto, M. Hoshino, T. Shimizu, R. Horiuchi	Special Topic Articles: Overview and Prospect- Frontier Researches in Magnetic Reconnection – 6. Summary – Present and Future of Magnetic Reconnection Research –	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	12	880-884	2013	unrefereed
368	R. Horiuchi	Special Topic Articles: Overview and Prospect- Frontier Researches in Magnetic Reconnection – 2. Recent Researches on Fast Magnetic Reconnection Mechanism 2.1 Dissipation of Current Sheet	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	11	759-764	2013	unrefereed
369	Y. Ono, R. Matsumoto, M. Hoshino, T. Shimizu, R. Horiuchi	Special Topic Articles:Overview and Prospect- Frontier Researches in Magnetic Reconnection 1. Introduction – Rapid Progress in Interdisciplinary Research of Magnetic Reconnection	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	11	753-758	2013	unrefereed
370	A. Iwamoto, T. Fujimura, M. Nakai, T. Norimatsu, H. Sakagami, H. Shiraga, H. Azechi	Review Papers:Development of Cryogenic Targets for Fast Ignition Laser Fusion Experiment	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	8	517-528	2013	refereed
371	T. Johzaki, A. Sunahara, H. Nagatomo, H. Sakagami, S. Fujioka, H. Shiraga, K. Mima	Contributed Papers:Enhancement of Energy Coupling Efficiency in Fast-Ignition Laser Fusion by Electron Beam Guiding with Self-Generated Magnetic Field	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	7	456-461	2013	refereed
372	T. Yamamoto, M. Emoto, H. Nakanishi	Special Topic Articles:Status of Remote Experiments for ITER 3.Technologies for High-Speed Data Transfer and Remote Experiments' Data Analyses	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	7	474-478	2013	unrefereed
373	K. Ida, K. Kamiya, Y. Suzuki	Commentary:Plasma Boundary of 3D MHD Equilibrium Inferred from Flow Patterns	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	5	319-327	2013	unrefereed
374	H. Naitou, S. Satake	Lecture Note:Methods of Fusion Plasma Simulation – Utilizing Massively-Parallel Computation – 5. Coding Techniques of Particle Simulations	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	4	245-260	2013	unrefereed
375	T. Watanabe, Y. Idomura		プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	3	171-179	2013	unrefereed

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376	H. Miura, Y. Todo, T. Gotoh	Methods of Fusion Plasma Simulation —Utilizing Massively-Parallel Computation— 3. Coding Techniques of MHD Simulations	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	2	119-127	2013	unrefereed
377	H. Sakagami		プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	1	49-56	2013	unrefereed
378	T. Watanabe	Lecture Note: Methods of Fusion Plasma Simulation - Utilizing Massively-Parallel Computation - 1. Introduction	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	89	1	45-48	2013	unrefereed
379	H. Sugama, T. Watanabe	Studies of Turbulence in Magnetized Plasmas Based on Gyrokinetic Theory: From Fusion to Space	日本物理学会誌(BUTSURI)	68	5	296-304	2013	unrefereed

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380	H. Takahashi, T. Shimozuma, S. Kubo, Y. Yoshimura, H. Igami, S. Ito, Y. Mizuno, K. Okada, T. Muto, K. Nagaoka, S. Murakami, M. Osakabe, I. Yamada, H. Nakano, M. Yokoyama, T. Ido, A. Shimizu, R. Seki, K. Ida, M. Yoshinuma, T. Kariya, R. Minami, T. Imai	Extension of High Te Regime with Upgraded ECRH System in the LHD	AIP conference proceedings	1580		145	2014	unrefereed
381	Y. Feng, H. Frerichs, M. Kobayashi, A. Bader, F. Effenberg, D. Harting, H. Hoelbe, J. Huang, G. Kawamura, J. Lore, T. Lunt, D. Reiter, O. Schmitz, D. Sharma	Recent Improvements in the EMC3-Eirene Code	Contributions to Plasma Physics	54	4-6	426-431	2014	refereed
382	K. Kamiya, G. Matsunaga, M. Honda, N. Miyato, H. Urano, Y. Kamada, K. Ida, K. Itoh	Edge Radial Electric Field Formation after the L-H Transition on JT-60U	Contributions to Plasma Physics	54	4-6	591-598	2014	refereed
383	G. Kawamura, Y. Feng, M. Kobayashi, M. Shoji, T. Morisaki, S. Masuzaki, Y. Tomita	First EMC3-EIRENE simulations with divertor legs of LHD in realistic device geometry	Contributions to Plasma Physics	54	4-6	437-441	2014	refereed
384	K. Yamanaka, S. Urushidani, H. Nakanishi, T. Yamamoto, Y. Nagayama	A TCP/IP-based constant-bit-rate file transfer protocol and its extension to multipoint data delivery	Fusion Engineering and Design	89	5	770-774	2014	refereed
385	H. Nakanishi, M. Ohsuna, M. Kojima, S. Imazu, M. Nonomura, M. Emoto, T. Yamamoto, Y. Nagayama, T. Ozeki, N. Nakajima, K. Ida, O. Kaneko	Revised cloud storage structure for light-weight data archiving in LHD	Fusion Engineering and Design	89	5	707-711	2014	refereed
386	S. Saito, A. Ito, A. Takayama, H. Nakamura	Grain size dependence of penetration depth of hydrogen injection into polycrystalline graphite by molecular simulation	Japanese Journal of Applied Physics	53	11S	11RF04	2014	refereed
387	M. Hashida, L. Gemini, T. Nishii, Y. Miyasaka, H. Sakagami, M. Shimizu, S. Inoue, J. Limpouch, T. Mocek, S. Sakabe	Periodic Grating Structures on Metal Self-organized by Double-pulse Irradiation	Journal of Laser Micro/Nanoengineering	9	3	234-237	2014	refereed

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388	A. Takayama, A. Ito, Y. Oda, H. Nakamura	First principles investigation of cluster consisting of hydrogen–helium atoms interstitially–trapped in tungsten	Journal of Nuclear Materials	463		355–358	2014	refereed
389	S. Toda, M. Nunami, A. Ishizawa, T. Watanabe, H. Sugama	How to apply a turbulent transport model based on a gyrokinetic simulation for the ion temperature gradient mode in helical plasmas	Journal of Physics: Conference Series	561		12020	2014	refereed
390	S. Usami, R. Horiuchi, H. Ohtani, M. Den	Multi–Hierarchy Simulation of Collisionless Driven Reconnection by Real–Space Decomposition	Journal of Physics: Conference Series	561	1	012021–1–10	2014	refereed
391	T. Watanabe, Y. Idomura, S. Maeyama, M. Nakata, H. Sugama, M. Nunami, A. Ishizawa	Exploring phase space turbulence in magnetic fusion plasmas	Journal of Physics: Conference Series	510		12045	2014	refereed
392	A. Ishizawa	Commentary:Two– and Gyro–Fluid Models and their Application to MHD Instabilities	Journal of Plasma and Fusion Research	90	4	213–227	2014	refereed
393	A. Sanpei, K. Nishimura, S. Masamune, H. Tanaka, H. Himura, S. Ohdachi, N. Mizuguchi, T. Akiyama	Measurement and Evaluation of 3–D Structure in Low–Aspect–Ratio RFP RELAX with Dual SXR Imaging System	JPS Conference Proceedings	1	1	015027–1–015027–4	2014	refereed
394	M. Sasaki, N. Kasuya, K. Itoh, M. Yagi, S. Itoh	Dynamical response of turbulent structures in cylindrical magnetized plasmas	JPS Conference Proceedings	1		015011–1–015011–5	2014	refereed
395	A. Matsuyama, M. Yagi, Y. Kagei, N. Nakajima	Drift resonance effect on stochastic runaway electron orbit in the presence of low–order magnetic perturbations	Nuclear Fusion	54	12	123007	2014	refereed
396	M. Sasaki, N. Kasuya, K. Itoh, M. Yagi, S. Itoh	Nonlinear competition of turbulent structures and improved confinement in magnetized cylindrical plasmas	Nuclear Fusion	54	11	114009	2014	refereed
397	S. Itoh, K. Itoh	Zero–dimensional model for the critical condition for the L?H transition in the flux?gradient relation	Nuclear Fusion	54	11	114017	2014	refereed
398	M. Honda, S. Satake, Y. Suzuki, G. Matsunaga, K. Shinohara, M. Yoshida, A. Matsuyama, S. Ide, H. Urano	Experimental analyses and predictive simulations of toroidal rotation driven by the neoclassical toroidal viscosity in rippled tokamaks	Nuclear Fusion	54	11	114005	2014	refereed
399	S. Koike, S. Kitajima, A. Okamoto, K. Ishii, Y. Sato, J. Tachibana, T. Oku, K. Shimizu, S. Inagaki, Y. Suzuki, H. Takahashi, M. Takayama	Bursting high–frequency fluctuation observed in biased plasma in TU–Heliac	Nuclear Fusion	54	11	114013	2014	refereed

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400	T. Yamada, S. Inagaki, T. Kobayashi, Y. Nagashima, T. Mitsuzono, Y. Miwa, K. Nakanishi, H. Fujino, M. Sasaki, N. Kasuya, M. Lesur, Y. Kosuga, A. Fujisawa, S. Itoh, K. Itoh	End plate biasing experiments in linear magnetized plasmas	Nuclear Fusion	54	11	114010	2014	refereed
401	J. Cheng, J. Dong, K. Itoh, L. Yan, W. Hong, K. Zhao, Z. Huang, X. Ji, W. Zhong, D. Yu, S. Itoh, L. Nie, X. Song, Q. Yang, X. Ding, X. Zou, X. Duan, Y. Liu	Low?intermediate?high confinement transition in HL-2A tokamak plasmas	Nuclear Fusion	54	11	114004	2014	refereed
402	S. Inagaki, T. Tokuzawa, T. Kobayashi, S. Itoh, K. Itoh, K. Ida, A. Fujisawa, S. Kubo, T. Shimozuma, N. Tamura, N. Kasuya, H. Tsuchiya, Y. Nagayama	Study of Non-linear Coupling of Fluctuations at Long Distance in LHD	Nuclear Fusion	54	11	114014	2014	refereed
403	A. Bierwage, Y. Todo, N. Aiba, K. Shinohara	Dynamics of low-n shear Alfvén modes driven by energetic N-NB ions in JT-60U	Nuclear Fusion	54	10	104001	2014	refereed
404	Y. Todo, M. Zeeland, A. Bierwage, W. Heidbrink	Multi-phase simulation of fast ion profile flattening due to Alfven eigenmodes in a DIII-D experiment	Nuclear Fusion	54	10	104012-1-104012-13	2014	refereed
405	T. Kobayashi, K. Itoh, T. Ido, K. Kamiya, S. Itoh, Y. Miura, Y. Nagashima, A. Fujisawa, S. Inagaki, K. Ida, N. Kasuya, K. Hoshino	Dynamics of edge limit cycle oscillation in the JFT-2M Tokamak	Nuclear Fusion	54	7	073017-1-14	2014	refereed
406	J. Miyazawa, Y. Suzuki, S. Satake, R. Seki, Y. Masaoka, S. Murakami, M. Yokoyama, Y. Narushima, M. Nunami, T. Goto, C. Suzuki, I. Yamada, R. Sakamoto, H. Yamada, A. Sagara	Physics analyses on the core plasma properties in the helical fusion DEMO reactor FFHR-d1	Nuclear Fusion	54	4	43010	2014	refereed
407	J. Miyazawa, Y. Suzuki, S. Satake, R. Seki, Y. Masaoka, S. Murakami, M. Yokoyama, Y. Narushima, M. Nunami, T. Goto, C. Suzuki, I. Yamada, R. Sakamoto, H. Yamada, A. Sagara	Physics Analyses on the Core Plasma Properties in the Helical Fusion DEMO Reactor FFHR-d1	Nuclear Fusion	54	43010	1-9	2014	refereed

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408	K. Toi, S. Ohdachi, Y. Suzuki, F. Watanabe, K. Tanaka, S. Sakakibara, K. Ogawa, M. Isobe, X. Du, T. Akiyama, M. Goto, K. Ida, S. Masuzaki, T. Morisaki, S. Morita, K. Narihara, Y. Narushima, T. Tokuzawa, I. Yamada, R. Yasuhara, M. Yoshinuma, K. Kawahata, H. Yamada	Mitigation of large amplitude edge-localized modes by resonant magnetic perturbations on LHD	Nuclear Fusion	54	3	33001	2014	refereed
409	T. Ozaki, A. Sunahara, H. Shiraga, Y. Arikawa, S. Fujioka, H. Sakagami, Z. Zhang, H. Nagatomo, T. Johzaki, T. Namimoto, M. Taga, S. Kojima, Y. Abe, K. Ishihara, T. Nagai, S. Sakata, S. Hattori, Y. Sakawa, H. Nishimura, H. Azechi	Hot electron spectra in hole-cone shell targets and a new proposal of the target for fast ignition in laser fusion	Physica Scripta	2014	T161	14025	2014	refereed
410	K. Kamiya, M. Honda, H. Urano, M. Yoshida, Y. Kamada, K. Itoh	Boundary condition for toroidal plasma flow imposed at the separatrix in high confinement JT-60U plasmas with edge localized modes and the physics process in pedestal structure formation	Physics of Plasmas	21	12	122517	2014	refereed
411	D. Mikkelsen, M. Nunami, T. Watanabe, H. Sugama, K. Tanaka	Verification of gyrokinetic microstability codes with an LHD configuration	Physics of Plasmas	21	11	112305	2014	refereed
412	N. Kasuya, S. Sugita, S. Inagaki, K. Itoh, M. Yagi, S.	On violation of local closure of transport relation in high-temperature magnetized plasmas	Physics of Plasmas	21	11	110701	2014	refereed
413	S. Hudson, Y. Suzuki	Chaotic coordinates for the Large Helical Device	Physics of Plasmas	21	10	102505-1-102505-14	2014	refereed
414	D. Mikkelsen, K. Tanaka, M. Nunami, T. Watanabe, H. Sugama, M. Yoshinuma, K. Ida, Y. Suzuki, M. Goto, B. Wieland, I. Yamada, R. Yasuhara, T. Tokuzawa, T. Akiyama, N. Pablant	Quasilinear Carbon Transport in an Impurity Hole Plasma in LHD	Physics of Plasmas	21	8	082302-1-082302-1	2014	refereed
415	H. Miura, K. Araki	Structure transitions induced by the Hall term in homogeneous and isotropic magnetohydrodynamic turbulence	Physics of Plasmas	21	7	072313-1-072313-10	2014	refereed

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416	H. Zhu, S. Chapman, R. Dendy, K. Itoh	Transitions to improved confinement regimes induced by changes in heating in zero-dimensional models for tokamak plasmas	Physics of Plasmas	21	6	62307	2014	refereed
417	H. Takahashi, T. Shimozuma, S. Kubo, Y. Yoshimura, H. Igami, S. Ito, S. Kobayashi, Y. Mizuno, K. Okada, T. Muto, K. Nagaoka, S. Murakami, M. Osakabe, I. Yamada, H. Nakano, M. Yokoyama, T. Ido, A. Shimizu, R. Seki, K. Ida, M. Yoshinuma, T. Kariya, R. Minami, T. Imai	Extension of high T e regime with upgraded electron cyclotron resonance heating system in the Large Helical Device	Physics of Plasmas	21	6	061506-1-061506-8	2014	refereed
418	R. Ueda, K. Watanabe, Y. Matsumoto, M. Itagaki, M. Sato, S. Oikawa	Characteristics of magnetic island formation due to resistive interchange instability in helical plasma	Physics of Plasmas	21	5	52502	2014	refereed
419	T. Tokuzawa, S. Inagaki, K. Ida, K. Itoh, T. Ido, A. Shimizu, H. Takahashi, S. Kitajima, N. Tamura, M. Yoshinuma, H. Tsuchiya, I. Yamada, K. Tanaka, T. Akiyama, Y. Nagayama, K. Kawahata, K. Watanabe, H. Yamada	Observation of multi-scale turbulence and non-local transport in LHD plasmas	Physics of Plasmas	21	5	055904-1-055904-6	2014	refereed
420	A. Ishizawa, T. Watanabe, H. Sugama, S. Maeyama, N. Nakajima	Electromagnetic gyrokinetic turbulence in finite-beta helical plasmas	Physics of Plasmas	21	5	055905-1-055905-10	2014	refereed
421	Y. Asahi, A. Ishizawa, T. Watanabe, H. Tsutsui, S. Tsuji-Iio	Regulation of electron temperature gradient turbulence by zonal flows driven by trapped electron modes	Physics of Plasmas	21	5	052306-1-052306-10	2014	refereed
422	S. Maeyama, A. Ishizawa, T. Watanabe, M. Nakata, N. Miyato, M. Yagi, Y. Idomura	Comparison between kinetic-ballooning-mode-driven turbulence and ion-temperature-gradient-driven turbulence	Physics of Plasmas	21	5	052301-1-052301-12	2014	refereed
423	H. Sugama, T. Watanabe, M. Nunami	Extended gyrokinetic field theory for time-dependent magnetic confinement fields	Physics of Plasmas	21	1	012515-1-012515-15	2014	refereed
424	T. Tokuzawa, S. Inagaki, A. Ejiri, R. Soga, I. Yamada, S. Kubo, M. Yoshinuma, K. Ida, C. Suzuki, K. Tanaka, T. Akiyama, N. Kasuya, K. Itoh, K. Watanabe, H. Yamada, K. Kawahata	Ka-band Microwave Frequency Comb Doppler Reflectometer System for the Large Helical Device	Plasma and Fusion Research	9	Regular Issue	1402149-1-1402149-6	2014	refereed

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425	M. Yokoyama	A statistical approach for predicting thermal diffusivity profiles in fusion plasmas as a transport model	Plasma and Fusion Research	9	Regular Issue	1302137	2014	refereed
426	K. Ichiguchi, Y. Suzuki, M. Sato, Y. Todo, S. Sakakibara, S. Ohdachi, Y. Narushima	Three-dimensional Numerical Analysis of Pressure Driven Mode in RMP-Imposed LHD Plasma	Plasma and Fusion Research	9	Special Issue 2	3403134-1-3403134-5	2014	refereed
427	M. Shoji, Y. Tanaka, A. Pigarov, R. Smirnov, S. Masuzaki, G. Kawamura, Y. Uesugi, H. Yamada	Simulation Analysis of Dust-Particle Transport in the Peripheral Plasma in the Large Helical Device	Plasma and Fusion Research	9	Special Issue 2	3403132-1-3403132-4	2014	refereed
428	Y. Oda, A. Ito, A. Takayama, H. Nakamura	First-Principles Study on Migration of Vacancy in Tungsten	Plasma and Fusion Research	9	Special Issue 2	3401117-1-	2014	refereed
429	R. Ishizaki, N. Nakajima	MHD Simulations of Pellet Injection in the LHD	Plasma and Fusion Research	9	Special Issue 2	33403130-1-3403130-5	2014	refereed
430	R. Goto, H. Miura, A. Ito, M. Sato, T. Hatori	Hall and gyro-viscosity effects on the Rayleigh-Taylor instability in a 2D rectangular slab	Plasma and Fusion Research	9	Regular Issue	1403076-1-	2014	refereed
431	R. Horiuchi, S. Usami, H. Ohtani	Influence of a Guide Field on Collisionless Driven Reconnection	Plasma and Fusion Research	9	Regular Issue	1401092-1-	2014	refereed
432	T. Yanagawa, H. Sakagami, A. Sunahara, H. Nagatomo	Implosion Simulation by Hydro Code Coupled with Laser Absorption using New Raytrace Algorithm	Plasma and Fusion Research	9	Special Issue 2	3404090-1-	2014	refereed
433	S. Fujiwara, M. Hashimoto, Y. Tamura, H. Nakamura, R. Horiuchi	Molecular Dynamics Simulation of Micellar Shape Transition in Amphiphilic Solutions	Plasma and Fusion Research	9	Special Issue 2	3401067-1-3401067-4	2014	refereed
434	Y. Narushima, S. Sakakibara, S. Ohdachi, K. Watanabe, S. Nishimura, Y. Suzuki, M. Furukawa, Y. Takemura, K. Ida, M. Yoshinuma, I. Yamada	Observation of hysteretic magnetic island response to Resonant Magnetic Perturbation in LHD	Plasma and Fusion Research	9	Regular Issue	1202066-1-1202066-2	2014	refereed
435	Y. Fujita, S. Ikuno, H. Nakamura	Transmission Efficiency in Complex-Shaped Waveguide using Real Metals	Plasma and Fusion Research	9	Special Issue 2	3401074-1-	2014	refereed
436	Y. Todo, A. Bierwage	Large-Scale Simulation of Energetic Particle Driven Magnetohydrodynamic Instabilities in ITER Plasmas	Plasma and Fusion Research	9	Special Issue 2	3403068-1-	2014	refereed
437	K. Hagita, H. Ohtani, T. Kato, S. Ishiguro	TOKI compression for plasma particle simulation	Plasma and Fusion Research	9	Special Issue 2	3403401083-1-3401083-6	2014	refereed
438	N. Ohno, H. Ohtani	Development of in-situ visualization tool for PIC simulation	Plasma and Fusion Research	9	Special Issue 2	3401071-1-	2014	refereed
439	M. Nakata, A. Matsuyama, N. Aiba, S. Maeyama, M. Nunami, T. Watanabe	Local gyrokinetic Vlasov simulations with realistic tokamak MHD equilibrium	Plasma and Fusion Research	9	Regular Issue	1403029	2014	refereed
440	T. Gotoh, T. Watanabe, H. Miura	Spectrum of Passive Scalar at Very High Schmidt Number in Turbulence	Plasma and Fusion Research	9	Special Issue 2	3401019-1-	2014	refereed

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441	M. Yokoyama, R. Seki, C. Suzuki, M. Emoto, K. Ida, M. Osakabe, S. Murakami, Y. Suzuki, S. Satake, M. Nunami, A. Fukuyama, H. Yamada	Integration of Large-Scale Simulations and Numerical Modelling Tools in Close Link with the LHD Experiment	Plasma and Fusion Research	9	Special Issue 2	3402017-1-3402017-5	2014	refereed
442	S. Morita, E. Wang, M. Kobayashi, C. Dong, T. Oishi, Y. Feng, M. Goto, X. Huang, S. Masuzaki, I. Murakami, Y. Suzuki, T. Watanabe	Two-dimensional study of edge impurity transport in the Large Helical Device	Plasma Physics and Controlled Fusion	56	9	094007-1-094007-10	2014	refereed
443	M. Osakabe, H. Takahashi, K. Nagaoka, S. Murakami, I. Yamada, M. Yoshinuma, K. Ida, M. Yokoyama, R. Seki, H. Lee, Y. Nakamura, N. Tamura, S. Sudo, K. Tanaka, T. Seki, Y. Takeiri, H. Yamada, O. Kaneko	Impact of carbon impurities on the confinement of high-ion-temperature discharges in the Large Helical Device	Plasma Physics and Controlled Fusion	56	9	095011-1-10	2014	refereed
444	H. Usui, A. Nagara, M. Nunami, M. Matsumoto	Development of a Computational Framework for Block-Based AMR Simulations	Procedia Computer Science	29		2351-2359	2014	refereed
445	T. Ozaki, S. Kojima, Y. Arikawa, H. Shiraga, H. Sakagami, S. Fujioka, R. Kato	An Electron/Ion Spectrometer with the Ability of Low Energy Electron Measurement for Fast Ignition Experiment	Review of Scientific Instruments	85	11	11E113	2014	refereed
446	T. Kobayashi, G. Birkenmeier, E. Wolfrum, F. Laggner, M. Willensdorfer, U. Stroth, S. Inagaki, S. Itoh, K. Itoh	Method for estimating the propagation direction of a coherent plasma structure using a one-dimensional diagnostic array	Review of Scientific Instruments	85	8	083507-1-083507-6	2014	refereed
447	K. Nishimura, A. Sanpei, H. Tanaka, G. Ishii, R. Kodera, R. Ueba, H. Himura, S. Masamune, S. Ohdachi, N. Mizuguchi	2D electron temperature diagnostic using soft x-ray imaging technique	Review of Scientific Instruments	85	3	33502	2014	refereed
448	S. Ishiguro, H. Ohtani	Commentary:Experience the Fusion Plasma -to Experience is to Believe-	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	90	6	325-331	2014	unrefereed
449	K. Kusano, H. Hasegawa	Chapter 1 "Preface", Special Topic Articles "Space Climatology"	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	90	2	105-106	2014	unrefereed
450	R. Horiuchi	Project Review:The Numerical Simulation Research Project at the National Institute for Fusion Science	プラズマ・核融合学会誌 (Journal of Plasma and Fusion Research)	90	1	2-39	2014	unrefereed

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451	M. Nakata, M. Nunami, T. Watanabe, H. Sugama	Improved collision operator for plasma kinetic simulations with multi-species ions and electrons	Computer Physics Communications	inpress			2015	refereed
452	Y. Tomita, Z. Huang, Y. Pan, G. Kawamura, L. Yan	Secondary electron emission from a charged spherical dust particle due to electron incidence according to OML model	Journal of Nuclear Materials	463		881-884	2015	refereed
453	S. Dai, S. Liu, J. Sun, A. Kirschner, G. Kawamura, D. Tskhakaya, R. Ding, G. Luo, D. Wang	Modelling of surface evolution of rough surface on divertor target in fusion devices	Journal of Nuclear Materials	463		372-376	2015	refereed
454	A. Ito, A. Takayama, Y. Oda, T. Tamura, R. Kobayashi, T. Hattori, S. Ogata, N. Ohno, S. Kajita, M. Yajima, Y. Noiri, Y. Yoshimoto, S. Saito, S. Takamura, T. Murashima, M. Miyamoto, H. Nakamura	Hybrid simulation research on formation mechanism of tungsten nanostructure induced by helium plasma irradiation	Journal of Nuclear Materials	463		109-115	2015	refereed
455	M. Shoji, S. Masuzaki, Y. Tanaka, A. Pigarov, R. Smirnov, G. Kawamura, Y. Uesugi, H. Yamada	Analysis of the three-dimensional trajectories of dusts observed with a stereoscopic fast framing camera in the Large Helical Device	Journal of Nuclear Materials	463		861-864	2015	refereed
456	S. Morita, M. Kobayashi, T. Oishi, H. Zhang, M. Goto, Z. Cui, C. Dong, L. Hu, X. Huang, G. Kawamura, S. Masuzaki, I. Murakami, E. Wang	Effect of neutral hydrogen on edge impurity behavior in stochastic magnetic field layer of Large Helical Device	Journal of Nuclear Materials	463		644-648	2015	refereed
457	M. Kobayashi, Y. Feng, Y. Xu, F.L. Tabares, K. Ida, O. Schmitz, T.E. Evans, H. Frerichs, Y. Liang, A. Bader, K. Itoh, H. Yamada, Ph. Ghendrih, G. Ciraolo, D. Tafalla, A. Lopez-Fraguas, H.Y. Guo, Z.Y. Cui, D. Reiter, N. Asakura, U. Wenzel, S. Morita, N. Ohno, B.J. Peterson, S. Masuzaki	Impact of 3D magnetic field structure on boundary and divertor plasmas in stellarator/heliotron devices	Journal of Nuclear Materials	463		2-10	2015	refereed
458	A. Ishizawa, S. Maeyama, T. Watanabe, H. Sugama, N. Nakajima	Electromagnetic gyrokinetic simulation of turbulence in torus plasmas	Journal of Plasma Physics	81	2	435810203-1-435810203-41	2015	refereed
459	T. Yanagawa, H. Sakagami, A. Sunahara, H. Nagatomo	Asymmetric implosion of a cone-guided target irradiated by Gekko XII laser	Laser and Particle Beams	33	3	367-378	2015	refereed

No	著者 / Author	タイトル / Title	雑誌名 / Journal	Vol	Issue	Page	Year	査読有/無
460	K. Ida, M. Yoshinuma, H. Tsuchiya, T. Kobayashi, C. Suzuki, M. Yokoyama, A. Shimizu, K. Nagaoka, S. Inagaki, K. Itoh	Flow damping due to stochastization of the magnetic field	Nature Communications	6		5816	2015	refereed
461	Y. Todo, M. Zeeland, A. Bierwage, W. Heidbrink, M. Austin	Validation of comprehensive magnetohydrodynamic hybrid simulations for Alfvén eigenmode induced energetic particle transport in DIII-D plasmas	Nuclear Fusion	55	7	73020	2015	refereed
462	S. Inoue, Y. Ono, H. Tanabe, R. Horiuchi, C. Cheng	Numerical study of energy conversion mechanism of magnetic reconnection in the presence of high guide field	Nuclear Fusion	55	8	83014	2015	refereed
463	T. Ido, M. Osakabe, A. Shimizu, T. Watari, M. Nishiura, K. Toi, K. Ogawa, K. Itoh, I. Yamada, R. Yasuhara, Y. Yoshimura, S. Kato	Identification of the energetic-particle driven GAM in the LHD	Nuclear Fusion	55	8	83024	2015	refereed
464	K. Ichiguchi, Y. Suzuki, M. Sato, Y. Todo, T. Nicolas, S. Sakakibara, S. Ohdachi, Y. Narushima, B. Carreras	Three-dimensional MHD analysis of heliotron plasma with RMP	Nuclear Fusion	55	7	73023	2015	refereed
465	Y. Narushima, S. Sakakibara, S. Ohdachi, Y. Suzuki, K. Watanabe, S. Nishimura, S. Satake, B. Huang, M. Furukawa, Y. Takemura, K. Ida, M. Yoshinuma, I. Yamada	Experimental observation of response to Resonant Magnetic Perturbation and its hysteresis in LHD	Nuclear Fusion	55	7	73004	2015	unrefereed
466	T. Goto, J. Miyazawa, R. Sakamoto, R. Seki, C. Suzuki, M. Yokoyama, S. Satake, A. Sagara, F. Group	Integrated physics analysis of plasma start-up scenario of helical reactor FFHR-d1	Nuclear Fusion	55	6	63040	2015	refereed
467	M. Shoji, H. Kasahara, M. Tokitani, T. Seki, K. Saito, S. Kamio, R. Seki, Y. Tanaka, A. Pigarov, R. Smirnov, G. Kawamura, S. Masuzaki, Y. Uesugi, T. Muto	Studies of dust transport in long pulse plasma discharges in the large helical device	Nuclear Fusion	55	5	53014	2015	refereed
468	Y. Hamada, T. Watari, A. Nishizawa, O. Yamagishi, K. Narihara, K. Ida, Y. Kawasumi, T. Ido, M. Kojima, K. Toi	Microtearing mode (MTM) turbulence in JIPPT-IIU tokamak plasmas	Nuclear Fusion	55	4	43008	2015	refereed
469	T. Johzaki, T. Taguchi, Y. Sentoku, A. Sunahara, H. Nagatomo, H. Sakagami, K. Mima, S. Fujioka, H. Shiraga	Control of an electron beam using strong magnetic field for efficient core heating in fast ignition	Nuclear Fusion	55	53022	1-7	2015	refereed

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470	A. Ishizawa, T. Watanabe, H. Sugama, M. Nunami, K. Tanaka, S. Maeyama, N. Nakajima	Turbulent transport of heat and particles in a high ion temperature discharge of the Large Helical Device	Nuclear Fusion	55	4	043024-1-043024-8	2015	refereed
471	K. Ichiguchi, S. Sakakibara, S. Ohdachi, B. Carreras	Multi-Scale MHD Analysis of LHD Plasma with Background Field Changing	Nuclear Fusion	55	4	43019	2015	refereed
472	K. Ida, J. Kwon, M. Leconte, W. Ko, S. Inagaki, Y. Todo, Y. Kosuga	The 4th Asia-Pacific Transport Working Group (APTWG) Meeting	Nuclear Fusion	55	1	017001-1-10	2015	refereed
473	K. Ida, Z. Shi, H. Sun, S. Inagaki, K. Kamiya, J. Rice, N. Tamura, P. Diamond, G. Dif-Pradalier, X. Zou, K. Itoh, S. Sugita, O. Gurcan, T. Estrada, C. Hidalgo, T. Hahm, A. Field, X. Ding, Y. Sakamoto, S. Oldenburger, M. Yoshinuma, T. Kobayashi, M. Jiang, S. Hahn, Y. Jeon, S. Hong, Y. Kosuga, J. Dong, S. Itoh	Towards an Emerging Understanding of Non-locality Phenomena and Non-local Transport	Nuclear Fusion	55	1	13022	2015	refereed
474	S. Sakakibara, K. Watanabe, Y. Takemura, M. Okamoto, S. Ohdachi, Y. Suzuki, Y. Narushima, K. Ida, M. Yoshinuma, K. Tanaka, T. Tokuzawa, I. Yamada, H. Yamada, Y. Takeiri, . LHD Experiment Group	Characteristics of MHD instabilities limiting the beta value in LHD	Nuclear Fusion	55	8	83020	2015	refereed
475	T. Kobayashi, K. Itoh, T. Ido, K. Kamiya, S. Itoh, Y. Miura, Y. Nagashima, A. Fujisawa, S. Inagaki, K. Ida, K. Hoshino	Edge plasma dynamics during L-H transition in the JFT-2M tokamak	Nuclear Fusion	55	6	63009	2015	refereed
476	A. Ito, A. Takayama, Y. Oda, T. Tamura, R. Kobayashi, T. Hattori, S. Ogata, N. Ohno, S. Kajita, M. Yajima, Y. Noiri, Y. Yoshimoto, S. Saito, S. Takamura, T. Murashima, M. Miyamoto, H. Nakamura	Molecular dynamics and Monte Carlo hybrid simulation for fuzzy tungsten nanostructure formation	Nuclear Fusion	55	7	73013	2015	refereed
477	T. Iwawaki, H. Habara, T. Yabuuchi, M. Hata, H. Sakagami, K. Tanaka	Slowdown mechanisms of ultraintense laser propagation in critical density plasma	Physical Review E	92	1	13106	2015	refereed

No	著者 / Author	タイトル / Title	雑誌名 / Journal	Vol	Issue	Page	Year	査読有/無
478	S. Fujioka, T. Johzaki, Y. Arikawa, Z. Zhang, M. Alesio, T. Ikenouchi, T. Ozaki, T. Nagai, Y. Abe, S. Kojima, S. Sakata, H. Inoue, M. Utsugi, S. Hattori, T. Hosoda, S. Lee, K. Shigemori, Y. Hironaka, A. Sunahara, H. Sakagami, K. Mima, Y. Fujimoto, K. Yamanoi, T. Norimatsu, S. Tokita, Y. Nakata, J. Kawanaka, T. Jitsuno, N. Miyanaga, M. Nakai, H. Nishimura, H. Shiraga, H. Nagatomo, H. Azechi	Heating efficiency evaluation with mimicking plasma conditions of integrated fast-ignition experiment	Physical Review E	91	6	63102	2015	refereed
479	X. Du, K. Toi, M. Osakabe, S. Ohdachi, T. Ido, K. Ida, K. Tanaka, M. Yokoyama, M. Yoshinuma, K. Ogawa, M. Isobe, K. Nagaoka, T. Ozaki, S. Sakakibara, R. Seki, Y. Suzuki	Resistive Interchange Modes Destabilized by Helically Trapped Energetic Ions in a Helical Plasma	Physical Review Letters	114	15	155003	2015	refereed
480	C. Cheng, S. Inoue, Y. Ono, R. Horiuchi	Physical Processes of Driven Magnetic Reconnection in Collisionless Plasmas: Zero Guide Field Case	Physics of Plasmas	22	10	101205	2015	refereed
481	H. Wang, Y. Todo, T. Ido, M. Osakabe	Simulation Study of High-Frequency Energetic Particle Driven Geodesic Acoustic Mode	Physics of Plasmas	22	9	92507	2015	refereed
482	H. Sugama, T. Watanabe, M. Nunami	Effects of collisions on conservation laws in gyrokinetic field theory	Physics of Plasmas	22	8	82306	2015	refereed
483	S. Matsuoka, S. Satake, R. Kanno, H. Sugama	Effects of magnetic drift tangential to magnetic surfaces on neoclassical transport in non-axisymmetric plasma	Physics of Plasmas	22	7	72511	2015	refereed
484	M. Toida, J. Inagaki	Effects of trapped electrons on ion reflection in an oblique shock wave	Physics of Plasmas	22	6	062305 (12pages)	2015	refereed
485	C. Moon, T. Kobayashi, K. Itoh, R. Hatakeyama, T. Kaneko	Ion scale nonlinear interaction triggered by disparate scale electron temperature gradient mode	Physics of Plasmas	22	5	52301	2015	refereed
486	M. Sasaki, N. Kasuya, T. Kobayashi, H. Arakawa, K. Itoh, F. Kohei, T. Yamada, M. Yagi, S. Itoh	Formation mechanism of steep wave front in magnetized plasmas	Physics of Plasmas	22	3	32315	2015	refereed
487	R. Goto, H. Miura, A. Ito, M. Sato, T. Hatori	Formation of large-scale structures with sharp density gradient through Rayleigh-Taylor growth in a 2D slab under the two-fluid and FLR effects	Physics of Plasmas	22	3	32115	2015	refereed

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488	T. Watanabe, H. Sugama, A. Ishizawa, M. Nunami	Flux tube train model for local turbulence simulation of toroidal plasmas	Physics of Plasmas	22	2	22507	2015	refereed
489	Y. Asahi, A. Ishizawa, T. Watanabe, H. Sugama	Nonlinear Entropy Transfer in ETG-TEM Turbulence via TEM Driven Zonal Flows	Plasma and Fusion Research	10	Regular Issue	1403047	2015	refereed
490	M. Nunami, M. Nakata, T. Watanabe, H. Sugama	Development of Linearized Collision Operator for Multiple Ion Species in Gyrokinetic Flux-tube Simulations	Plasma and Fusion Research	10	Regular Issue	1403058	2015	refereed
491	C. Moon, K. Ida, T. Tokuzawa, K. Tanaka, M. Yoshinuma, T. Kobayashi, S. Inagaki, K. Itoh, . LHD Experiment Group	Study of Nonlinear Behavior of Low-Frequency MHD mode Caused by Transition of Radial Electric Field in LHD	Plasma and Fusion Research	10	3402053		2015	refereed
492	T. Nicolas, K. Ichiguchi, M. Sato, Y. Todo, Y. Suzuki, A. Ishizawa, S. Sakakibara	Three-dimensional numerical analysis of two-fluid effects on interchange mode in heliotron plasmas	Plasma and Fusion Research	10	3403018		2015	refereed
493	S. Fujiwara, T. Miyata, M. Hashimoto, Y. Tamura, H. Nakamura, R. Horiuchi	Molecular Dynamics Simulation of Phase Behavior in a Bolaamphiphilic Solution	Plasma and Fusion Research	10		3401029-1-3401029-4	2015	refereed
494	T. Nicolas, K. Ichiguchi, M. Sato, Y. Todo, Y. Suzuki, A. Ishizawa, S. Sakakibara	Three-Dimensional Numerical Analysis of Ion Diamagnetic Effects on Interchange Mode in Heliotron Plasmas	Plasma and Fusion Research	10		3403018-1-3403018-6	2015	refereed
495	N. Kasuya, S. Sugita, S. Inagaki, K. Itoh, M. Yagi, S. Itoh	Simulation study of hysteresis in the gradient-flux relation in toroidal plasma turbulence	Plasma Physics and Controlled Fusion	57	4	44010	2015	refereed
496	K. Ida, T. Kobayashi, S. Inagaki, Y. Suzuki, S. Sakakibara, K. Itoh, H. Tsuchiya, C. Suzuki, M. Yoshinuma, Y. Narushima, M. Yokoyama, S. Itoh	Topology bifurcation of a magnetic flux surface in toroidal plasmas	Plasma Physics and Controlled Fusion	57	1	14036	2015	refereed
497	K. Itoh, T. Kobayashi, T. Ido, S. Itoh, K. Kamiya	Contribution of Geodesic Acoustic Modes in the Limit Cycle Oscillation near H-mode Transition in JFT-2M Plasmas	Plasma Physics and Controlled Fusion	57	9	92001	2015	refereed
498	H. Miura, K. Araki	Commentary: Physics of Hall Effects on MHD Turbulence and Its Modelling	プラズマ・核融合学会誌(Journal of Plasma and Fusion Research)	91	7	411-448	2015	unrefereed
499	H. Sugama	Lecture Note: Particle Kinetics – from Planets to Charged Particles, 2. Lie Transform Perturbation Theory for Hamiltonian Systems and its Application to Guiding Center Motion	プラズマ・核融合学会誌(Journal of Plasma and Fusion Research)	1	91	51-68	2015	unrefereed

Documents

3. List of Published Papers by Students in 2010-2015

学生論文リスト (2010-2015年) / List of published papers by students in 2010-2015

No	著者 / Author	タイトル / Title	雑誌名 / Journal	Vol	Issue	page	Year	査読有/無
1	M. Nakata, T. Watanabe, H. Sugama, W. Horton	Formation of coherent vortex streets and transport reduction in electron temperature gradient driven turbulence	Physics of Plasmas	17	4	042306-1-042306-13	2010	refereed
2	S. Maeyama, A. Ishizawa, T. Watanabe, M. Škorić, N. Nakajima, S. Tsuji-Iio, H. Tsutsui	Effects of time-varying E×B flow on slab ion-temperature-gradient turbulence	Physics of Plasmas	17	6	062305-1-062305-9	2010	refereed
3	K. Saito, K. Ichiguchi, N. Ohyabu	Interaction between Static Magnetic Islands and Interchange modes in a Straight Heliotron Plasma with High Resistivity	Physics of Plasmas	17	6	062504-1-062504-14	2010	refereed
4	M. Yokoyama, S. Matsuoka, H. Funaba, K. Ida, K. Nagaoka, M. Yoshinuma, Y. Takeiri, O. Kaneko	Considerations from the Viewpoint of Neoclassical Transport Towards Higher Ion Temperature Heliotron Plasmas	Contributions to Plasma Physics	50	6-7	586-589	2010	refereed
5	M. Nakata, T. Watanabe, H. Sugama, W. Horton	Effects of parallel dynamics on vortex structures in electron temperature gradient driven turbulence	Physics of Plasmas	18	1	012303-1-012303-11	2011	refereed
6	K. Kashimura, J. Fukushima, M. Sato	Oxygen Partial Pressure Change with Metal Titanium Powder Nitriding under Microwave Heating	ISIJ International	51	2	181-185	2011	refereed
7	S. Matsuoka, S. Satake, M. Yokoyama, A. Wakasa, S. Murakami	Neoclassical electron transport calculation by using δf Monte Carlo method	Physics of Plasmas	18	3	032511-1-032511-11	2011	refereed
8	S. Matsuoka, S. Satake, M. Yokoyama, A. Wakasa	Radial Electric Field Formation Including Electron Radial Drift for a Core Electron-Root Confinement (CERC) Plasma in LHD	Plasma and Fusion Research	6		1203016-1-1203016-3	2011	refereed
9	M. Hata, H. Sakagami, A. Sunahara, T. Johzaki, H. Nagatomo	Effects of preformed plasma of CH foam on fast electron generation	Journal of Physics: Conference Series	244	2	022037-1-4	2010	unrefereed
10	H. Nakamura, A. Ito, S. Saito, Y. Tamura, S. Fujiwara, N. Ohno, S. Kajita	Comparison of Hydrogen Adsorption on Diamond and Graphite Surfaces	Plasma and Fusion Research	5	Special Issue 2	S2072-1-S2072-4	2010	refereed
11	A. Ito, H. Okumura, S. Saito, H. Nakamura	Examination of Temperature Dependence of Chemical Sputtering on Graphite by Comparing the Langevin and Berendsen Thermostats	Plasma and Fusion Research	5	Special Issue 2	S2020-1-S2020-4	2010	refereed
12	S. Saito, A. Ito, H. Nakamura	Molecular Dynamics Simulation of the Incident Angle Dependence of Reactions between Graphene and Hydrogen Atom	Plasma and Fusion Research	5	Special Issue 2	S2076-1-S2076-4	2010	refereed
13	A. Takayama, S. Saito, A. Ito, T. Kenmotsu, H. Nakamura	Extension of Binary-Collision-Approximation-Based Simulation Applicable to Any Structured Target Material	Japanese Journal of Applied Physics	50	1	01AB03-1-01AB03-4	2011	refereed
14	A. Ito, A. Takayama, S. Saito, N. Ohno, S. Kajita, H. Nakamura	Molecular Dynamics Simulation of Chemical Vapor Deposition of Amorphous Carbon: Dependence on H/C Ratio of Source Gas	Japanese Journal of Applied Physics	50	1S1	01AB01-1-01AB01-6	2011	refereed
15	H. Nakamura, A. Ito, S. Saito, A. Takayama, Y. Tamura, N. Ohno, S. Kajita	Molecular Dynamics Simulation of Hydrogen Injection onto Diamond Surfaces	Japanese Journal of Applied Physics	50		01AB04-1-01AB04-4	2011	refereed

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16	K. Saito, K. Ichiguchi, R. Ishizaki	Effect of parallel diffusion of equilibrium pressure on interaction between interchange mode and static magnetic island	Plasma and Fusion Research	6	7	2403072	2011	refereed
17	S. Saito, A. Ito, A. Takayama, T. Kenmotsu, H. Nakamura	Hybrid simulation between molecular dynamics and binary collision approximation codes for hydrogen injection into carbon materials	Journal of Nuclear Materials	415	1S	S208-S211	2011	refereed
18	H. Wang, Y. Todo	Interaction between Energetic Particles and Alfven Eigenmodes in Reversed Shear Plasmas	Journal of the Physical Society of Japan	80	9	094501-1-094501-7	2011	refereed
19	S. Saito, A. Takayama, A. Ito, T. Kenmotsu, H. Nakamura	How to Combine Binary Collision Approximation and Multi-body Potential for Molecular Dynamics	Progress in Nuclear Science and	2		44-50	2011	refereed
20	S. Saito, A. Ito, H. Nakamura	Reaction between Graphene and Hydrogen under Oblique Injection	Journal of Applied Physics	110	8	084320-1-084320-9	2011	refereed
21	S. Saito, A. Ito, A. Takayama, H. Nakamura	Anisotropic Bond Orientation of Amorphous Carbon by Deposition	Japanese Journal of Applied Physics	51		01AC05-1-01AC05-5	2012	refereed
22	K. Saito, K. Ichiguchi, R. Ishizaki	Numerical Calculation of MHD Equilibria including Static Magnetic Islands in a Straight Heliotron Configuration by Means of a Field Line Tracing Method	Plasma and Fusion Research	7	5	2403032	2012	refereed
23	M. Hata, H. Sakagami, A. Sunahara, T. Johzaki, H. Nagatomo	Effects of CH foam preplasma on fast ignition	Laser and Particle Beams	30	2	189-197	2012	refereed
24	K. Saito, K. Ichiguchi, R. Ishizaki	Low Beta MHD Equilibrium Including a Static Magnetic Island for Reduced MHD Equations in a Straight Heliotron Configuration	Plasma and Fusion Research	7	7	3403018	2012	refereed
25	M. Hashida, Y. Miyasaka, M. Shimizu, T. Ogata, H. Sakagami, S. Tokita, S. Sakabe	Mechanism of femtosecond laser nano-ablation for metals	ALT Proceedings	1		140-141	2012	unrefereed
26	S. Inoue, S. Tokita, K. Otani, M. Hashida, M. Hata, H. Sakagami, T. Taguchi, S. Sakabe	Autocorrelation Measurement of Fast Electron Pulses Emitted through the Interaction of Femtosecond Laser Pulses with a Solid Target	Physical Review Letters	109	185001	1-5	2012	refereed
27	K. Saito, K. Ichiguchi, R. Ishizaki	Numerical Analysis of Resistive Interchange Mode in Equilbria Consistent with Static Magnetic Islands in a Straight Heliotron Configuration	Plasma and Fusion Research	7	12	1403156	2012	refereed
28	A. Ito, A. Takayama, S. Saito, H. Nakamura	Formation and Classification of Amorphous Carbon by Molecular Dynamics Simulation	Japanese Journal of Applied Physics	52	1S	01AL04-1-01AL04-7	2013	refereed
29	H. Wang, Y. Todo	Linear Properties of Energetic Particle Driven Geodesic Acoustic Mode	Physics of Plasmas	20	1	012506-1-012506-8	2013	refereed
30	S. Saito, A. Ito, A. Takayama, H. Nakamura	Structural Change of Single-Crystalline Graphite under Plasma Irradiation	Japanese Journal of Applied Physics	52	1	01AL02-1-01AL02-6	2013	refereed
31	H. Wang, Y. Todo, C. Kim	Hole-clump pair creation in the evolution of energetic-particle-driven geodesic acoustic modes	Physical Review Letters	110	15	155006-1-155006-5	2013	refereed
32	M. Hata, H. Sakagami, A. Das	Kinetic effects on robustness of electron magnetohydrodynamic structures	Physics of Plasmas	20	4	042303-1-042303-6	2013	refereed
33	M. Hata, H. Sakagami, T. Johzaki, H. Nagatomo	Effects of laser profiles on fast electron generation under the same laser energy	Laser and Particle Beams	31		371-377	2013	refereed

No	著者 / Author	タイトル / Title	雑誌名 / Journal	Vol	Issue	page	Year	査読有/無
34	T. Yanagawa, H. Sakagami, H. Nagatomo	Simulation analysis of the effects of an initial cone position and opening angle on a cone-guided implosion	Physics of Plasmas	20	10	102703-1-102703-7	2013	refereed
35	M. Hata, H. Sakagami, T. Johzaki, H. Nagatomo	EFFECTS OF LASER TEMPORAL PROFILE ON FAST ELECTRON CHARACTERISTICS	EPJ Web of Conferences	59	17004	17004-p.1-17004-p.4	2013	refereed
36	N. Kashima, H. Nakamura, A. Takayama, Y. Tamura, S. Kubo	Finite-Difference Time-Domain Simulation on Transmission of Millimeter Waves through Miter Bends	Japanese Journal of Applied Physics	52	11	11ND02-1-11ND02-2	2013	refereed
37	H. Nagatomo, T. Johzaki, A. Sunahara, H. Sakagami, T. Yanagawa, K. Mima	Optimum design of imploded core plasma for effective fast ignition at GXII	EPJ Web of Conferences	59	3007	1-4	2013	refereed
38	T. Yanagawa, H. Sakagami, H. Nagatomo	Three-dimensional simulations of asymmetric implosion for cone-guided targets	EPJ Web of Conferences	59		03008-p.1-03008-p.4	2013	refereed
39	H. Nakamura, N. Kashima, A. Takayama, K. Sawada, Y. Tamura, S. Fujiwara, S. Kubo	Optimization of a corrugated millimeter-wave waveguide and a miter bend by FDTD simulation	Journal of Physics: Conference Series	410		12046	2013	refereed
40	Y. Asahi, A. Ishizawa, T. Watanabe, H. Tsutsui, S. Tsuji-Iio	Regulation of electron temperature gradient turbulence by zonal flows driven by trapped electron modes	Physics of Plasmas	21	5	052306-1-052306-10	2014	refereed
41	Y. Fujita, S. Ikuno, H. Nakamura	Transmission Efficiency in Complex-Shaped Waveguide using Real Metals	Plasma and Fusion Research	9	Special Issue 2	3401074-1-	2014	refereed
42	R. Goto, H. Miura, A. Ito, M. Sato, T. Hatori	Hall and gyro-viscosity effects on the Rayleigh-Taylor instability in a 2D rectangular slab	Plasma and Fusion Research	9	Regular Issue	1403076-1-	2014	refereed
43	T. Yanagawa, H. Sakagami, A. Sunahara, H. Nagatomo	Implosion Simulation by Hydro Code Coupled with Laser Absorption using New Raytrace Algorithm	Plasma and Fusion Research	9	Special Issue 2	3404090-1-	2014	refereed
44	N. Kashima, H. Nakamura, Y. Tamura, A. Ito, S. Kubo	Interactive visualization system to analyze corrugated millimeter-waveguide component of ECH in nuclear fusion with FDTD simulation	Journal of Physics: Conference Series	490	1	12179	2014	refereed
45	R. Goto, H. Miura, A. Ito, M. Sato, T. Hatori	Formation of large-scale structures with sharp density gradient through Rayleigh-Taylor growth in a 2D slab under the two-fluid and FLR effects	Physics of Plasmas	22	3	32115	2015	refereed
46	Y. Asahi, A. Ishizawa, T. Watanabe, H. Sugama, H. Tsutsui, S. Tsuji-Iio	Nonlinear Entropy Transfer in ETG-TEM Turbulence via TEM Driven Zonal Flows	Plasma and Fusion Research	10	Regular Issue	1403047	2015	refereed
47	Y. Narushima, S. Sakakibara, S. Ohdachi, Y. Suzuki, K. Watanabe, S. Nishimura, S. Satake, B. Huang, M. Furukawa, Y. Takemura, K. Ida, M. Yoshinuma, I. Yamada	Experimental observation of response to Resonant Magnetic Perturbation and its hysteresis in LHD	Nuclear Fusion	55	7	73004	2015	refereed
48	T. Iwawaki, H. Habara, T. Yabuuchi, M. Hata, H. Sakagami, K. Tanaka	Slowdown mechanisms of ultraintense laser propagation in critical density plasma	Physical Review E	92	1	13106	2015	refereed
49	T. Yanagawa, H. Sakagami, A. Sunahara, H. Nagatomo	Asymmetric implosion of a cone-guided target irradiated by Gekko XII laser	Laser and Particle Beams	33	3	367-378	2015	refereed
50	H. Wang, Y. Todo, T. Ido, M. Osakabe	Simulation Study of High-Frequency Energetic Particle Driven Geodesic Acoustic Mode	Physics of Plasmas	22	9	92507	2015	refereed

References

Table of Evaluation Results for the 2015 External Peer Review “Numerical Simulation Reactor Research Project”

Table of Evaluation Results for the 2015 External Peer Review “Numerical Simulation Reactor Research Project”

Number of persons

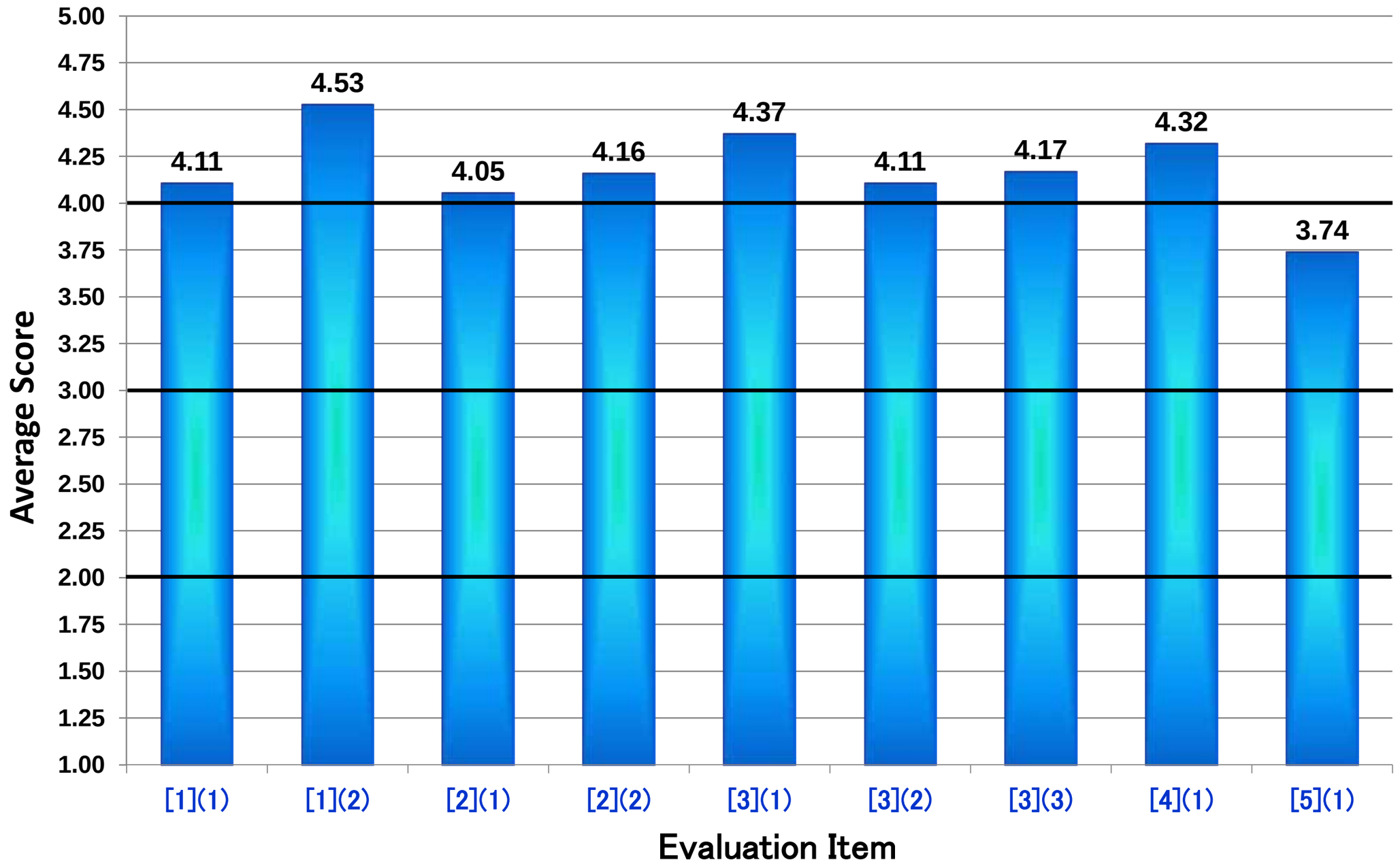
Items	[1](1)	[1](2)	[2](1)	[2](2)	[3](1)	[3](2)	[3](3)	[4](1)	[5](1)
S	6	10	7	7	7	6	5	6	2
A	9	9	7	8	12	10	11	13	12
B	4	0	4	4	0	2	2	0	3
C	0	0	1	0	0	1	0	0	2
D	0	0	0	0	0	0	0	0	0
Avg. Score	4.11	4.53	4.05	4.16	4.37	4.11	4.17	4.32	3.74

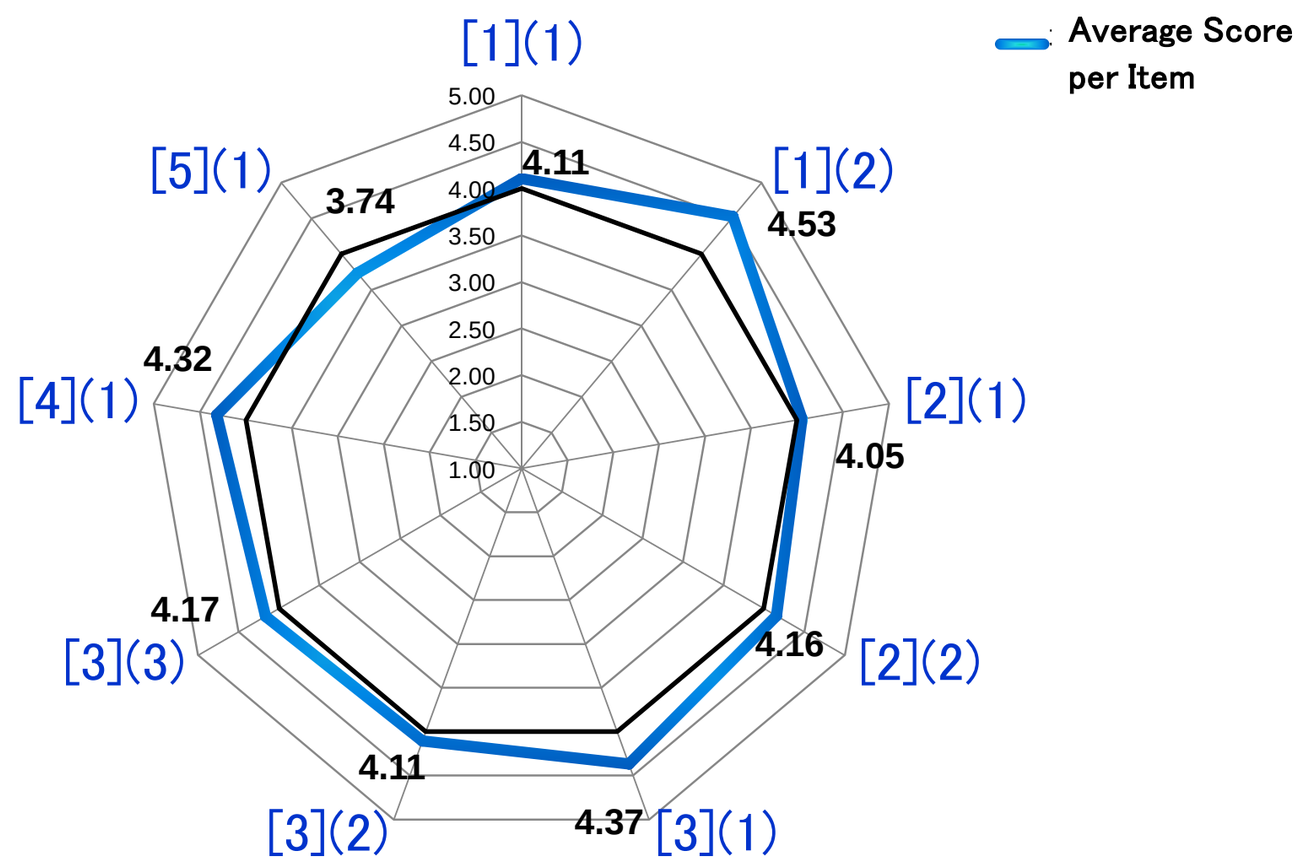
Evaluation Response Table		
S	Evaluate extremely high	5
A	Evaluate highly	4
B	Praised	3
C	Satisfactory	2
D	Not satisfactory	1

※ The evaluation results combine the results from the members based in Japan and the members based abroad. As there are committee members who did not respond to all items, the number of responses differs for each item.

Items	Points for Evaluation
[1]	**Development of Research System and Environment**
[1](1)	Does the research system function appropriately in accomplishing the objectives of the Numerical Simulation Reactor Research Project (NSRP)?
[1](2)	Is the environment of the “Plasma Simulator” system and its related research developed appropriately? Is the “Plasma Simulator” effectively utilized for collaboration research?
[2]	**Research Achievements** Does the NSRP produce high-level achievements in accordance with international standards for the following research areas by promoting theory and computer simulation research utilizing the Plasma Simulator?
[2](1)	Construction of the Numerical Test Reactor for a helical fusion system
[2](2)	Physics mechanisms of fusion plasmas and their theoretical systemization
[3]	**Promotion of Cooperation and Collaboration**
[3](1)	Does the NSRP promote collaboration research as the center of excellence by integrating the high capabilities of universities and institutes?
[3](2)	Does the NSRP contribute to the development of research in universities? Does the NSRP function as a research hub for the dissemination of academic information to other fields?
[3](3)	Does the NSRP promote international cooperation through contributions to ITER, BA activities, and other international collaborations?
[4]	**Human Resources Development**
[4](1)	Does the NSRP contribute to the development of human resources for the international scientific workforce required for long-term fusion science through simulation research?
[5]	**Future Planning**
[5](1)	Is the NSRP research plan for progressing toward the realization of the objectives appropriate? Is the research plan suitable for the next decade?

Average Score by Evaluation Item





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