

Office of Science
Notice DE-FG01-04ER04-11

*Theoretical Research
in Plasma and Fusion Science*

Department of Energy

Office of Science Financial Assistance Program Notice DE-FG01-04ER04-11; Theoretical Research in Plasma and Fusion Science

AGENCY: U.S. Department of Energy

ACTION: Notice inviting grant applications.

SUMMARY: The Office of Fusion Energy Sciences (OFES) of the Office of Science (SC), U.S. Department of Energy (DOE), announces its interest in receiving grant applications for theoretical research relevant to the U.S. program in magnetic fusion energy sciences. All individuals or groups planning to submit applications for new or renewal funding in Fiscal Year 2005 should submit in response to this Notice.

The specific areas of interest are:

1. Magnetohydrodynamics and Stability
2. Confinement and Transport
3. Edge and Divertor Physics
4. Plasma Heating and Non-inductive Current Drive
5. Innovative/Integrating Concepts
6. Atomic and Molecular Processes in Plasmas

More specific information on each area of interest is outlined in the general and program specific supplementary information section below. OFES may also solicit proposals from time to time under separate announcements of Initiatives to support coordinated, goal-directed community efforts. The Initiatives will be funded to achieve specific programmatic and scientific aims and will be subject to requirements that are different from those of this notice. Such grants, if funded, will be subject to periodic reviews of progress.

Due to the limited availability of funds, Principal Investigators with continuing grants may not submit a new application in the same area(s) of interest as their previous application(s), which received funding. A Principal Investigator may submit only one application under each area of interest as listed above.

DATES: To permit timely consideration for awards in Fiscal Year 2005, applications submitted in response to this notice must be received by DOE no later than 4:30 p.m., Eastern Time, April

1, 2004. Electronic submission of formal applications in PDF format is required. It is important that the submission be in a single PDF file.

Applicants are requested to submit a letter-of-intent by March 4, 2004, which includes the title of the application, the name of the Principal Investigator(s), the requested funding and a one- page abstract. These letters-of-intent will be used to organize and expedite review processes. Failure to submit a letter-of-intent will not negatively prejudice a responsive formal application submitted in a timely fashion. The letters-of-intent should be sent by E-mail to the following E-mail address: john.sauter@science.doe.gov and the Subject line should state: Letter-of-intent regarding Program Notice 04-11.

ADDRESSES: Formal applications referencing Program Notice DE-FG01-04ER04-11, must be electronically submitted by an authorized institutional business official through DOE's Industry Interactive Procurement System (IIPS) at: <http://e-center.doe.gov/>. IIPS provides for the posting of solicitations and receipt of applications in a paperless environment via the Internet. In order to submit applications through IIPS, your business official will need to register at the IIPS website. It is suggested that this registration be completed several days prior to the date on which you plan to submit the formal application. The Office of Science will include attachments as part of this notice that provide the appropriate forms in PDF fillable format that are to be submitted through IIPS. **IIPS offers the option of using multiple files, it is important that the submission be in a single PDF file if possible.** Color images should be submitted in IIPS as a separate file in PDF format and identified as such. These images should be kept to a minimum due to the limitations of reproducing them. They should be numbered and referred to in the body of the technical scientific grant application as Color image 1, Color image 2, etc. Questions regarding the operation of IIPS may be e-mailed to the IIPS Help Desk at: HelpDesk@pr.doe.gov, or you may call the help desk at: (800) 683-0751. Further information on the use of IIPS by the Office of Science is available at: <http://www.sc.doe.gov/production/grants/grants.html>.

If you are unable to submit an application through IIPS, please contact the Office of the Director, Grants and Contracts Division, Office of Science, DOE at: (301) 903-5212 in order to gain assistance for submission through IIPS or to receive special approval and instructions on how to submit printed applications.

FOR FURTHER INFORMATION CONTACT: Office of Fusion Energy Sciences, SC-55/Germantown Building, U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585-1290. Specific contacts for each area of interest, along with telephone numbers and Internet addresses, are listed below:

1. Magnetohydrodynamics and Stability: Rostom Dagazian, Research Division, SC-55, Telephone: (301) 903-4926, or by Internet address: rostrom.dagazian@science.doe.gov.

2. Confinement and Transport: Curt Bolton, Research Division, SC-55, Telephone: (301) 903-4914, or by Internet address: curt.bolton@science.doe.gov.

3. Edge and Divertor Physics: Mike Crisp, Research Division, SC-55, Telephone: (301) 903-4883, or by Internet address: michael.crisp@science.doe.gov.

4. Plasma Heating and Non-inductive Current Drive: Rostom Dagazian, Research Division, SC-55, Telephone: (301) 903-4926, or by Internet address: rostom.dagazian@science.doe.gov.

5. Innovative/Integrating Concepts: Francis Thio, Research Division, SC-55, Telephone (301)-903-4678, or by Internet address: francis.thio@science.doe.gov; or Steve Eckstrand, Research Division, SC-55, Telephone: (301) 903-5546, or by Internet address: steve.eckstrand@science.doe.gov.

6. Atomic and Molecular Processes in Plasmas: Mike Crisp, Research Division, SC-55, Telephone: (301) 903-4883, or by Internet address: michael.crisp@science.doe.gov.

SUPPLEMENTARY INFORMATION: General information about development and submission of applications, eligibility, limitations, evaluations and selection processes, and other policies and procedures may be found in the Application Guide for the Office of Science Financial Assistance Program and 10 CFR Part 605. Electronic access to SC's Financial Assistance Guide and required forms is possible via the Internet using the following Web site address: <http://www.sc.doe.gov/production/grants/grants.html>. DOE is under no obligation to pay for any costs associated with the preparation or submission of an application if an award is not made.

Program Funding

It is anticipated that about \$5,000,000 of Fiscal Year 2005 funding will be available to fund new work, or renewals of existing work, from applications received in response to this Notice. The number of awards and range of funding will depend on the number of applications received and selected for award. Since future year funding is not anticipated to increase, applications should propose constant effort in future years (allowing for inflation). Future year funding will depend upon suitable progress and the availability of funds. The cost-effectiveness of the application will be considered when comparing applications with differing funding requirements. The number of grants funded, and the amount of funding for each grant, will depend on the number and quality of the applications received.

Collaborative research projects involving more than one institution, as well as basic work in support of the Scientific Discovery through Advanced Computing initiative, are encouraged. Applications submitted from different institutions, which are directed at a common research activity, should clearly indicate they are part of a proposed collaboration and contain a brief description of the overall research project. However, each application must have a distinct scope of work and a qualified principal investigator, who is responsible for the research effort being performed at his or her institution. Synergistic collaborations with researchers in federal laboratories and Federally Funded Research and Development Centers (FFRDCs), including the DOE National Laboratories are also encouraged, though no funds will be provided to these organizations under this Notice. Further information on preparation of collaborative applications may be accessed via the Internet at: <http://www.science.doe.gov/production/grants/Colab.html>.

Since we expect that reviewers will be asked to review several applications, those applications from individual PIs or small groups (1-4 people) should be limited to a maximum of twenty (20) pages (including text and figures) of technical information, while applications from larger theory groups should be limited to thirty (30) pages. All applications should be in a single PDF file. The single PDF file may also include a few selected publications in an Appendix as background information. In addition, in the electronic submission, please limit biographical and publication information for the principal investigator and senior personnel to no more than two pages each. Each principal investigator should provide an E-mail address.

In addition to the information required by 10 CFR Part 605 each application should contain the following items: (1) a succinct statement of the goal of the research, (2) a detailed research plan, (3) the specific results expected at the end of the project period, (4) an analysis of the adequacy of the budget, (5) a discussion of the impact of the proposed research on other fields of science, and (6) for projects requiring significant computational resources (e.g., at the National Energy Research Scientific Computing Center), an estimate and justification of the resources that will be required. In addition if the work is to be part of the International Tokamak Physics Activity (ITPA) activities, the PI should include adequate funding to cover all the needed ITPA related travel.

Merit Review

Applications will be subjected to formal merit review and will be evaluated against the following criteria, which are listed in descending order of importance as set forth in 10 CFR Part 605. (<http://www.science.doe.gov/production/grants/605index.html>) Included with each criteria are the detailed questions that are asked of the reviewers.

1. Scientific and/or technical merit of the project,

- Does this application address an important problem in plasma science, plasma technology, fusion energy science, or fusion energy technology?
- How does the proposed research compare with other research in its field, both in terms of scientific and/or technical merit and originality?
- What is the likelihood that it will lead to new or fundamental advances in its field?

2. Appropriateness of the proposed method or approach,

- Are the conceptual framework, methods, and analyses adequately developed and likely to lead to scientifically valid conclusions?
- Does the proposed research employ innovative concepts or methods?
- Does the applicant recognize significant potential problems and consider alternative strategies?

3. Competency of the applicant's personnel and adequacy of the proposed resources,

- How well qualified are the applicant's personnel to carry out the proposed research? (If appropriate, please comment on the scientific reputation and quality of recent research by the principal investigator and other key personnel.)
- Please comment on the applicant's research environment and resources.
- Does the proposed work take advantage of unique facilities and capabilities and/or make good use of collaborative arrangements?

4. Reasonableness and appropriateness of the proposed budget.

- Is the proposed budget and staffing levels adequate to carry out the proposed research?

The reviewers are also asked to comment on **Other Appropriate Factors:**

- How is the proposed project relevant to the Office of Fusion Energy Science's goals?
- Could the proposed research make a significant contribution to another field?
- Is there potential for spin-offs?
- If applicable, please comment on the educational benefits of the proposed activity.

Scientific and technical merit also includes the importance and relevance of the proposed research to the U.S. fusion program. Accordingly, preference will be given to work based in the U.S.

In addition, proposals from theory groups will also be rated on the synergy of the group and the management of the group. With respect to synergy, the criteria are:

- 1) Clear evidence of collaborative work.
- 2) The extent to which the group addresses difficult problems requiring a team effort.

With respect to management the criteria are:

- 1) Clear evidence of scientific leadership.
- 2) The extent to which the management evaluates the relevance and scientific impact of the groups work.

The Office of Fusion Energy Sciences shall also consider, as part of the evaluation, other available advice or information as well as program policy factors, such as ensuring an appropriate balance among the program areas and within the program areas, ensuring support for major computational efforts, ensuring support for experiments, and quality of previous performance.

Selection of applications/proposals for award will be based upon the findings of the evaluations, the importance and relevance of the proposed research to the Office of Fusion Energy Sciences' mission, and funding availability.

Program Specific Information

1. Magnetohydrodynamics and Stability:

Grant applications are solicited for new research or continuation of past efforts in magnetohydrodynamics (MHD) theory in support of work on magnetically confined fusion plasmas. Current areas of interest include advanced tokamak (AT), innovative confinement concepts (ICC), burning plasma physics and steady state, high-beta plasma issues. Both analytical and computational approaches will be considered. Additional work is needed on nonlinear MHD codes to include new physics, such as extended MHD (including flows and various non-ideal MHD effects), resistive wall modes, and particularly neoclassical tearing modes. Finally, basic work in support of the Scientific Discovery through Advanced Computing initiative that involves the development of large-scale MHD codes will also be considered.

2. Confinement and Transport:

Applications will be considered in the area of confinement and transport in plasmas. This area covers plasma turbulence, energy, particle, momentum and radiation transport in the core of the plasma and theory based transport modeling. The work of interest includes work in support of tokamak as well as non-tokamak innovative concepts. Topics of interest include among others, electromagnetic effects on turbulence, shear flow generation and its impacts on transport, and understanding of the role of collisions in turbulent plasmas. Both analytical and computational work is of interest. Basic work in support of the Scientific Discovery through Advanced Computing initiative that involves the development of large-scale codes to explore turbulence will also be considered.

3. Edge and Divertor Physics:

Applications will be considered in the area of edge physics theory. This area covers edge plasma turbulence, energy, particle and radiation transport in the edge of the plasma and in the neighborhood of the separatrix. The work of interest includes neutrals transport in divertors and plasma edge region, atomic physics processes affecting temperature, radiation and flame front propagation in divertors, and pedestal and Elm theory and modeling. Both analytical and numerical models are of interest. Techniques and algorithms for modeling fast particles in the edge region, as well as adaptive grid methods and their application to modeling of plasma turbulence and transport in the edge region will be considered.

4. Plasma Heating and Non-inductive Current Drive:

Applications will be considered in the area of radio frequency (RF) physics in plasmas. This includes RF propagation, heating and current drive. Of interest are both analytical and numerical treatments of interaction of plasmas with radio frequency waves. These include electron cyclotron, ion cyclotron, lower hybrid, and Bernstein waves. Topics of interest include, among others, physical processes involved in conversion layers, power deposition for temperature profile control, and interaction of waves of different frequencies to produce specific effects on the plasma. Applications for modeling radio frequency launchers and their coupling to the edge plasma will also be considered.

5. Innovative/Integrating Concepts:

Grant applications are desired for theoretical and computational research on innovative concepts that have the possibility of leading to improved magnetic fusion systems. Increased theoretical and computational research is needed to help in the analysis of experimental data and aid in planning innovative fusion related experiments. Topics of interest include: equilibrium and stability of 3D systems, including island formation; extension of turbulence models to 3D systems; improvement in extended MHD modeling of RFPs; increased understanding of turbulent transport in RFPs; and spheromak formation. Applications are also desired for theoretical and computational research on integrated studies that include multiple topics.

6. Atomic and Molecular Processes in Plasmas:

Grant applications will be considered for theoretical research relevant to the description of atomic processes in plasmas. In addition to overall scientific merit, emphasis will be given to work that promises to aid the understanding of the basic atomic processes that are important for modeling of magnetically confined plasmas. Basic atomic processes that are important for modeling high energy density plasmas produced by high power lasers or ion beams may also be considered. The program has found understanding electron-atom and electron-ion collisions and the radiation emitted by atoms and ions to be of importance for the modeling of plasma behavior in experiments. Some current areas where atomic processes are considered to be important include the effects of transport, the effects of impurities and the understanding of diagnostics.

The Catalog of Federal Domestic Assistance number for this program is 81.049, and the solicitation control number is ERFAP 10 CFR Part 605.

Martin Rubinstein
Acting Director
Grants and Contracts Division
Office of Science

Published in the Federal Register February 19, 2004, Volume 69, Number 33, Pages 7740-7743.