

Office of Science
Notice DE-FG01-05ER05-08

*Theoretical Research
in Plasma and Fusion Science*

Department of Energy

Office of Science Financial Assistance Program Notice DE-FG01-05ER05-08; 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 2006 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 applications 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: A Letter-of-Intent (LOI) to submit an application is **REQUIRED** and should be submitted by **March 04, 2005**. Failure to submit a Letter-of-Intent by an applicant may preclude the full application from due consideration. The Letter-of- Intent should be

submitted electronically by email to John.Sauter@science.doe.gov and Curt.Bolton@science.doe.gov. Please include "Letter-of- Intent for Notice DE-FG01-05ER05-08" in the subject line.

To permit timely consideration for awards in Fiscal Year 2006, formal applications submitted in response to this notice must be received by DOE no later than 8:00 p.m., Eastern Time, April 5, 2005.

Please see the "Supplementary Information" section below for further instructions on the preparation of the Letter-of-Intent and the full application. Electronic submission of the formal application in PDF format is required. Please see the "Addresses" section below for further instructions on the method of submission for the formal application.

ADDRESSES: Formal applications referencing Program Notice DE-FG01-05ER05-08, 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. **Although IIPS offers the option of using multiple files, it is important that all applications submitted to this Program Notice be in a single PDF file.** 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.science.doe.gov/grants/IIPS-Instructions.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 E-mail: rostrom.dagazian@science.doe.gov.
2. Confinement and Transport: John Mandrekas, Research Division, SC-55, Telephone (301) 903-0552, or by E-mail: john.mandrekas@science.doe.gov.
3. Edge and Divertor Physics: Curt Bolton, Research Division, SC-55, Telephone (301) 903-4914, or by E-mail: curt.bolton@science.doe.gov.

4. Plasma Heating and Non-inductive Current Drive: Rostom Dagazian, Research Division, SC-55, Telephone (301) 903-4926, or by E-mail: rostrom.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 E-mail: steve.eckstrand@science.doe.gov.

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

SUPPLEMENTARY INFORMATION:

Letter-of-Intent

The purpose of the Letter-of-Intent (LOI) is to facilitate the OFES in planning the review and the selection of potential reviewers for the application. For this purpose, the LOI must include a short abstract of the proposed research areas and for each research area list the names and institutional affiliations of Principal Investigators, any Co-Principal Investigators, key investigators, collaborators or consultants, so as to reveal any potential conflict of interest in the selection of reviewers for the application.

Application

The application should be written in strict compliance with the following format:

1. Abstract - brief description of the project in no more than 250 words
2. Executive summary - summarize the application in no more than two pages
3. Background and Recent Accomplishments
 - 3.1. Background
 - 3.2. Recent Accomplishments - This subsection is mandatory for renewal applications and should summarize progress and impact on the fusion program under the existing award. It should also include the number of publications and a list of the publications that contained major contributions resulting from work funded by the previous grant.
4. Proposed research and tasks

In addition to the technical description of the proposed work and tasks, include a discussion of the following:

- Plans for comparison with experimental measurements where appropriate
- Impact of the proposed research on other fields of science, if appropriate
- Project schedules, milestones and deliverables

5. Textual summary of budget (in addition to the formal budget pages) - in particular, showing how the budget relates to the proposed research and task plans
6. Management plan (for groups of large size), including work breakdown structure that shows the level of effort for each task
7. Description of facilities, resources, and personnel
8. Other current and pending support.

Projects requiring significant computational resources (e.g., at the National Energy Research Scientific Computing Center, NERSC), should include 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 Principal Investigator (PI) should include adequate funding to cover all the needed ITPA related travel.

Applications from large groups (those requesting funding of \$1,000,000 per year or more) and whose scope of work includes more than one area of interest should be structured in a way that facilitates separate reviewing. This separation can be accomplished by breaking up sections 3, 4 and 6 of the application (*Background and Recent Accomplishments, Proposed Research and Management plan*, if appropriate) into self-contained parts which can then be assigned to be reviewed by peer reviewers whose areas of expertise are well-matched to the main focus of each proposed research task.

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 large theory groups should be limited to 20 pages per area of interest. 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.

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.science.doe.gov/grants/>. 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.

Collaborative research projects involving more than one institution, as well as basic work in support of the Scientific Discovery through Advanced Computing initiative (SciDAC), 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/grants/Colab.html>.

Program Funding

It is anticipated that about \$3,500,000 of Fiscal Year 2006 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.

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 605.10(d). Included with each criterion 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 or fusion energy science?
- 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?
- How adequate are the proposed plans to validate, where appropriate, the theoretical predictions with experimental measurements?

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. Performance under existing award (for renewal applications),

- Assess the progress the applicants made toward the research goals during the most recent performance period and the impact of the research on the fusion program.
- Have the applicants disseminated the results of their research through publications in peer-reviewed journals, meeting and conference presentations, workshops, or other appropriate means?
- If appropriate, have the applicants attempted to validate their theoretical predictions against experimental results?

5. 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:**

- Could the proposed research make a significant contribution to another field?
- If applicable, please comment on the educational benefits of the proposed activity.

In addition, applications from large theory groups will also be rated on the synergy 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.

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 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. Funding under this Notice is limited to supporting research activities based in the U.S., though subcontracts with limited funding for collaborators outside the U.S. may be allowed with appropriate justifications.

Program Specific Information

1. Magnetohydrodynamics and Stability:

Grant applications are solicited for new research or continuation of past efforts in magnetohydrodynamic (MHD) theory in support of work on magnetically confined fusion plasmas. Current areas of interest include advanced tokamaks (AT), innovative confinement concepts (ICC), burning plasma physics and steady state and 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, various non-ideal MHD phenomena, kinetic and energetic particle effects), resistive wall modes, and neoclassical tearing modes. Finally, basic work in support of the Scientific Discovery through Advanced Computing (SciDAC) Center for Extended Magnetohydrodynamic Modeling (CEMM) effort will also be considered.

2. Confinement and Transport:

Applications will be considered in the area of confinement and transport in plasmas. This area covers energy, particle, momentum and radiation transport in the core of the plasma including the effects of turbulence, collisions and energetic particles, and theory-based transport modeling. Work in support of tokamak as well as non-tokamak innovative concepts will be considered. Topics of special interest include electromagnetic effects on turbulence, electron thermal transport, large-scale and zonal flows, multi-scale effects on transport, turbulence suppression and transport barrier dynamics, and understanding of the role of collisions in turbulent plasmas. Both analytical and computational work are of interest. Basic work in support of the Scientific Discovery through Advanced Computing (SciDAC) initiative 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. Concepts of interest include but are not limited to compressional heating of magnetized plasmas, field reversed configuration, spheromak, levitated dipole, plasma jets, centrifugal confinement, reversed field pinch, spherical torus, and stellarator.

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.

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Office of Science

Posted on the Office of Science Grants and Contracts Web Site
February 9, 2005.