Office of Science
Notice DE-FG02-06ER06-07

Theoretical Research in Plasma and Fusion Science

U.S. Department of Energy

Office of Science Financial Assistance Program Notice
DE-FG02-06ER06-07; Theoretical Research in Plasma and Fusion Science

AGENCY: U.S. Department of Energy
Office of Science

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 2007 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 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 February 24, 2006. Failure to submit a Letter of Intent by an applicant may preclude the full application from due consideration.

Formal Applications submitted in response to this notice must be received by DOE no later than 8:00 p.m., Eastern Time, March 30, 2006, to permit timely consideration for awards in Fiscal Year 2007.

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: The Letter of Intent should be submitted electronically by email to: John.Sauter@science.doe.gov and John.Mandrekas@science.doe.gov. Please include "Letter-of-Intent for Notice DE-FG02-06ER06-07" in the subject line.

Formal Applications

Applications submitted to the Office of Science must be submitted electronically through Grants.gov to be considered for award. The Funding Opportunity Number is: DE-FG02-06ER06-03 and the CFDA Number for the Office of Science is: 81.049. Instructions and forms are available on the Grants.gov website. Please see the information below and also refer to the "Funding Opportunity Announcement", Part IV - Application and Submission Information; H. Other Submission and Registration Requirements for more specific guidance on "Where to Submit" and "Registration Requirements." If you experience problems when submitting your application to Grants.gov, please visit their customer support website: http://www.grants.gov/CustomerSupport; email: support@grants.gov; or call 1-800-518-4726.

Registration Requirements: There are several one-time actions you must complete in order to submit an application through Grants.gov (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contract Registry (CCR), register with the credential provider and register with Grants.gov). See http://www.grants.gov/GetStarted. Use the Grants.gov Organization Registration Checklist to guide you through the process. Designating an
E-Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in the CCR registration process. Applicants, who are not registered with CCR and Grants.gov, should allow at **least 14 days** to complete these requirements. It is suggested that the process be started as soon as possible.

VERY IMPORTANT - Download PureEdge Viewer: In order to download the application package, you will need to install PureEdge Viewer. This small, free program will allow you to access, complete, and submit applications electronically and securely. For a free version of the software, visit the following Web site: http://www.grants.gov/DownloadViewer.

FOR FURTHER INFORMATION CONTACT: Office of Fusion Energy Sciences, SC-24.2/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 E-mail addresses are listed below:

1. Magnetohydrodynamics and Stability: Rostom Dagazian, Research Division, SC-24.2, Telephone (301) 903-4926, or by E-mail: rostom.dagazian@science.doe.gov.

2. Confinement and Transport: John Mandrekas, Research Division, SC-24.2, Telephone (301) 903-0552, or by E-mail: john.mandrekas@science.doe.gov.

3. Edge and Divertor Physics: Curt Bolton, Research Division, SC-24.2, 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-24.2, Telephone (301) 903-4926, or by E-mail: rostom.dagazian@science.doe.gov; or Francis Thio, Research Division, SC-24.2, Telephone (301) 903-4678, or by E-mail: francis.thio@science.doe.gov

5. Innovative/Integrating Concepts: Francis Thio, Research Division, SC-24.2, Telephone (301) 903-4678, or by E-mail: francis.thio@science.doe.gov; or Steve Eckstrand, Research Division, SC-24.2, 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-24.2, Telephone (301) 903-4883, or by E-mail: michael.crisp@science.doe.gov.

SUPPLEMENTARY INFORMATION:

If the proposed work is to be part of the International Tokamak Physics Activity (ITPA), the Principal Investigator 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 objective can be accomplished by breaking up sections 3, 4 and 6 of the application below (*Background and Recent Accomplishments, Proposed Research and Tasks 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.

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.

Submission 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.

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.

The following is a list of essential items that an application must contain:

A. The Face Page SF-424 (R&R) - completed and signed by appropriate officials.

B. Research and Related Budget Page(s) (OMB Number: 4040-0001) using U.S. dollars, with supporting written justification sufficient to evaluate the costs of the proposed project. List and explain cost-sharing arrangements, if any. If the application is for a multi-year period, use one budget page for each year of requested support.

C. Research & Related Other Project Information

Project Summary/Abstract - The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (i.e., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as the Department may make it available to the public. It must not exceed 1 page when printed using standard 8.5" by 11" paper with 1" margins (top, bottom, left and right) with font not smaller than 11 point.

Project Narrative - Since we expect that some reviewers will be asked to review several applications, each application should be limited to a maximum of twenty (20) pages of technical information, including text and figures (sections 2 through 6 below), when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) and font not smaller than 11 point. Applications from large groups with multiple focus areas, as discussed above, should be limited to 20 pages per area of interest. Applications exceeding these page limits may be rejected without review. **All applications should be in a single PDF file, if possible**. The single PDF file may also include a few selected publications in an Appendix as background information. The page count of 20 does not include the Face Page and Budget Pages, the Title Page, the biographical material and publication information, or any Appendices. However, it is important that the 20- page technical information section provide a complete description of the proposed work, since reviewers are not obliged to read the Appendices. 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.

The narrative should be written in strict compliance with the following format and submitted to Grants.gov as a <u>single PDF file</u> attached as the Project Narrative (with the exception of the Abstract, as addressed above, which is attached separately when submitting through Grants.gov):

1. Title Page (*see description of required Title Page contents below*)

2. Executive summary - summarize the application in no more than two pages

3. Background and Recent Accomplishments

> **3.1.** Background - explanation of the importance and relevance of the proposed work
> **3.2.** Recent Accomplishments - this subsection is mandatory for renewal applications and should summarize the proposed work and the actual progress made during the previous funding period, as well as how the results of this work were communicated

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) showing how the budget relates to the proposed research and task plans

6. Management plan (for groups of large size), including work breakdown structure showing the level of effort for each task

7. Facilities and Resources - Include information on the experience of the applicant organization, its facilities and resources

8. Biographical Sketches: Detailed information about the background and experience of the principal investigator(s) and key personnel including references to publications (limit to 2 pages each)

9. Statement of all current and pending support for the project and all related projects, and description of support for all projects which involve the principal investigator(s) and the period of time devoted to each project

10. Bibliography of Literature

Note: Only the pages in Sections 2, 3, 4, 5 and 6 count towards the page count limit of 20 pages.

In addition, the title page of your narrative must include the following information:

Applicant/Institution:
Street Address/City/State/Zip:
Principal Investigator:
Address:
Telephone Number:
Email:
DOE/Office of Science Program Office:
DOE/Office of Science Program Office Technical Contact:
DOE Grant Number (if Renewal or Supplemental Application):
Is this a Collaboration? If yes, please list ALL Collaborating Institutions/PIs* and indicate which ones will also be submitting applications.

*** Note that collaborating applications must be submitted separately.**

Program Funding

It is anticipated that about $5,000,000 of Fiscal Year 2007 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;

- What important problem(s) in plasma or fusion science does this application address?
- 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;

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

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

- What are the overall strengths and weaknesses of the application?
- 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:

- Clear evidence of collaborative work.
- 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 fusion related Scientific Discovery through Advanced Computing (SciDAC) projects, including integration of several special physical models, will also be considered.

2. Confinement and Transport:

Applications in this programmatic area should focus on the understanding and control of the collisional and non-collisional physical processes that are responsible for the transport of heat, momentum and particles from the core of magnetically confined plasmas. Topics of special interest include electromagnetic effects on turbulence, electron thermal transport, large-scale and zonal flow generation, edge and core transport barrier formation and dynamics, multi-scale

effects on transport, and theory-based predictive transport modeling. Both analytical and computational approaches are of interest. Work in support of tokamaks as well as non-tokamak innovative confinement configurations will be considered. Basic work in support of the fusion related Scientific Discovery through Advanced Computing (SciDAC) projects 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. Basic work in support of the fusion related Scientific Discovery through Advanced Computing (SciDAC) projects and other large scale edge focused computational efforts will also be considered.

4. Plasma Heating and Non-inductive Current Drive:

Applications will be considered in the areas of plasma heating and non-inductive current drive. This includes RF propagation, heating and current drive, helicity injection, and plasma injection. 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. Efforts in support of integration of plasma-wave interaction theories into other fusion physics areas (e.g. transport) and 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. 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
Director
Grants and Contracts Division
Office of Science

Posted on the Office of Science Grants and Contracts Web Site
January 25, 2006.