

**Office of Science
Financial Assistance
Funding Opportunity Announcement
DE-PS02-09ER09-04**

ATTENTION
A change has been made
to the application due date from
December 10, 2008 to December 17, 2008.

Fusion Simulation Program

The Office of Fusion Energy Sciences (OFES) and the Office of Advanced Scientific Computing Research (OASCR) of the Office of Science (SC), U.S. Department of Energy (DOE), hereby announce their interest in receiving Cooperative Agreement applications for carrying out a detailed planning study for the Fusion Simulation Program (FSP). The goal of the FSP is to develop a world-leading, experimentally validated, predictive simulation capability for fusion plasmas in the regimes and geometries relevant for practical fusion energy. To accomplish this objective, the FSP will take advantage of the emergence of petascale computing capabilities and the scientific knowledge enabled by the OFES and OASCR research programs, in particular those under the auspices of the Scientific Discovery through Advanced Computing (SciDAC) program.

The purpose of the present Announcement is to competitively select a nationally coordinated interdisciplinary team consisting of fusion scientists and technologists, applied mathematicians, computer scientists, and computational scientists to carry out a one- to two-year detailed planning study for the FSP. The results of this study will help OFES and OASCR proceed with the full FSP, subject to the results of an independent review at the end of the planning period and the availability of appropriated funds. In addition to the technical and scientific issues expected to be addressed by this study, a detailed management plan will also be a key deliverable. The plan should define the simplest management structure that could effectively address the challenges of a geographically dispersed, multi-institutional research program with focused deliverables which engages diverse scientific communities. It should also consider how principles and concepts from project management can be used to help deal with issues such as flexibility in resource allocation for maintaining the appropriate balance among the various tasks throughout the duration of this research activity.

The team selected for carrying out the planning activity is expected to form the core of the FSP management structure, once the full program is authorized.

A companion Program Announcement to DOE Laboratories (LAB 09-04) will be posted on the Office of Science Grants and Contracts web site at:
http://www.science.doe.gov/grants/LAB09_04.html.

Additional information is provided in the **Supplementary Information** section below.

PREAPPLICATIONS DUE DATE: October 31, 2008, 8:00 PM Eastern Time

Potential Applicants are **REQUIRED** to submit a brief preapplication referencing Program Notice DE-PS02-09ER09-04 by 8:00 PM, October 31, 2008. Preapplications should be submitted electronically to john.mandrekas@science.doe.gov and john.sauter@science.doe.gov.

Preapplications should include cover page information, a brief description of the proposed work (3-5 pages, including text with minimum font size 11 point, figures, and references), and a one-page curriculum vitae from each Principal Investigator (PI) and senior collaborator. The cover page should include: (a) A statement that the document is a preapplication in response to Funding Opportunity Number 09-04; (b) PI information: name, institutional affiliation, telephone number, fax number, and e-mail address; and, (c) names and institutions of all co-Principal Investigators and senior collaborators (excluding postdoctoral associates). The description of the proposed work should include the applicant's vision of the planning stage of the FSP, the approach to be taken, program schedule, and information regarding the applicant's experience in managing large, multi-institutional, research projects.

Preapplications will be reviewed by OFES and OASCR program officials for responsiveness to this Funding Opportunity, eligibility of the applicant organization, and qualification of the applicant's personnel for carrying out a planning study for a large-scale computational research activity. Only those applicants who receive notification from DOE encouraging a full application may submit a formal application. **No other formal applications will be considered.**

APPLICATION DUE DATE: December 10, 2008, 8:00 PM Eastern Time

Applications must be submitted using Grants.gov, the Funding Opportunity Announcement can be found using the CFDA Number, 81.049 or the Funding Opportunity Announcement number, **DE-PS02-09ER09-04**. Applicants must follow the instructions and use the forms provided on Grants.gov.

PROGRAM MANAGER:

Dr. John Mandrekas, Office of Fusion Energy Sciences
PHONE: (301) 903-0552
FAX: (301) 903-4716
E-MAIL: John.Mandrekas@science.doe.gov

SUPPLEMENTARY INFORMATION:

The potential of integrated simulations to significantly contribute toward the FES mission of establishing the scientific basis for fusion energy as well as its long term goal of developing a

predictive capability for burning plasmas was recognized early by the fusion community. In 2001, the Integrated Simulation and Optimization of Fusion Systems (ISOFS) subcommittee of the Fusion Energy Sciences Advisory Committee (FESAC) recommended the initiation of a Fusion Simulation Project with the objective of developing an advanced simulation capability to reliably predict the behavior of plasma discharges in toroidal magnetic fusion devices on all relevant time and space scales. More recently, a community workshop - co-sponsored by OFES and OASCR - was held in May 2007 to refine the long term vision of the FSP and develop a detailed roadmap. The report which emerged from this workshop was recently evaluated by FESAC and the Advanced Scientific Computing Advisory Committee (ASCAC). These reports may be found at:

<http://www.science.doe.gov/ofes/programdocuments/reports/FSPWorkshopReport.pdf>
http://www.ofes.fusion.doe.gov/FESAC/Oct-2007/FESAC_FSP_report.pdf
http://www.sc.doe.gov/ascr/ASCAC/Reports/ASCAC_FSP_REPORT_FINAL.pdf

A major focus of the 2007 FSP workshop was the potential impact of the FSP on the U.S. participation in ITER. The FSP will be an important asset for maximizing the return of our investment in ITER while, at the same time, benefiting from this participation through the validation opportunities offered by the anticipated data from ITER, the world's first burning plasma experiment. However the scope of the FSP is much wider as it is being envisioned as a tool that embodies our predictive understanding of magnetically confined plasmas in regimes and geometries relevant for practical fusion energy, and properly coordinated and integrated with theory and experiment. In addition, for the FSP to deliver a true "whole device" modeling capability, its scope should include the entire region from the core of the plasma to the first wall, including the closely coupled plasma-materials interactions.

The FSP will also be a critical component of the initiative toward predictive plasma modeling and validation, as described in the recent "Priorities, Gaps, and Opportunities" FESAC report:

http://www.ofes.fusion.doe.gov/FESAC/Oct-2007/FESAC_Planning_Report.pdf

Applications should identify the key members of the proposed planning study team (the lead PI, institutional co-investigators, and senior collaborators) and include information about their experience in managing large multi-institutional and multidisciplinary research projects. The applications should also include detailed information on how the applicants propose to address the following issues during the detailed planning activity of the FSP:

- **FSP Deliverables:** The detailed planning study should consider the list of prioritized deliverables outlined in the 2007 FSP workshop report for each of the three five-year periods of the program. The study should critically evaluate and modify, if warranted, the original list of deliverables, taking into consideration both the near-term focus of this research effort (the ITER needs) and the long term vision for the FSP as outlined in the previous section. The planning study should include a credible assessment of the resources (in terms of Full Time Equivalent [FTE]) and mix of expertise (plasma physics, material science, applied math, and computer science) necessary to successfully complete each task or group of tasks. Accordingly, the applications should describe in detail the

method or approach that will be followed for determining the required resources and reassessing the list of deliverables for the FSP, as well as for developing clear and compelling Work Breakdown Structures.

- Comprehensive assessment of the present computational capabilities of the fusion community in terms of major simulation codes, numerical algorithms, computational science tools (data management, visualization, code performance tools, etc.), computational frameworks, interface standards, code scalability, and other related issues. Identification of major gaps and weaknesses, and suggestions for the path forward should also be addressed.
- Integration and coordination of the FSP with the projects in the FES SciDAC portfolio, including the process for incorporating results from the FES SciDAC Centers into the FSP.
- Integration and coordination of the FSP with other SciDAC (non-FES) Centers, and in particular with SciDAC Institutes and Centers for Enabling Technologies (CETs), as well as with efforts supported by the OASCR Applied Mathematics program.
- Integration and coordination with the FES analytic theory and modeling program, including the process for incorporating improved theoretical models into the FSP simulation codes and engaging the help of the FES theory community to address gaps in the physics models implemented in the FSP codes.
- Integration and coordination with the materials community for the purpose of addressing the plasma-materials interaction challenges.
- Details of the Applicants' vision and approach for developing a successful and credible Verification and Validation plan, including interaction and coordination with the FES experimental and diagnostic communities.
- Interaction and coordination with international integrated modeling efforts; in particular those undertaken by our ITER partners in support of the needs of the international ITER Organization (IO).
- Management Issues:
 - The applicant's vision and approach for developing a management plan that could effectively address the challenges of a geographically dispersed, multi-institutional research program with focused deliverables which engages diverse scientific communities. Applicants should also consider how principles and concepts from project management can be used to help deal with issues such as flexibility in resource allocation for maintaining the appropriate balance among the various tasks throughout the duration of this research activity, while providing clear accountability and oversight, and being responsive to the needs of the main stakeholders
 - Applicants should detail their approach for identifying the key (technical and non-technical) risks associated with a large-scale computational research effort such as the FSP, and outline their plans for developing risk mitigation strategies.
- High Performance Computing (HPC) Resource Requirements: As a major computational activity, the success of the FSP will critically depend on the availability of HPC resources. Applicants should describe in sufficient detail their approach for determining the required HPC resources for carrying out the various FSP tasks, including the appropriate mix of capacity and capability resources. Resources to be considered should include the current and projected capabilities at the SC leadership computing facilities, as

well as other resources (national or local) that can be reasonably expected to be available to the FSP researchers.

The expertise of the existing SciDAC teams is an important resource for the success of the FSP detailed planning study. Accordingly, the PIs of the existing FES SciDAC Centers will be available to support the FSP planning team.

Program Funding

Approximately \$2,000,000 will be available for this initiative in FY 2009. Additional funding may be available in FY 2010, subject to satisfactory progress during the first year of this activity and on the availability of appropriated funds. It is anticipated that one award will be made under this announcement. The above funding amount refers to the total available funding for both the Cooperative Agreements and the associated Lab Announcement 09-04. DOE is under no obligation to pay for any costs associated with preparation or submission of applications. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted.

Collaboration

Collaborative research projects with other institutions, such as universities, industry, non-profit organizations, and Federally Funded Research and Development Centers (FFRDCs), including the DOE National Laboratories, are encouraged under this Announcement. Applications submitted from different institutions, which are directed at a single 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. Further information on preparation of collaborative applications may be accessed via the Internet at: <http://www.science.doe.gov/grants/Colab.html>.

For further submission information please see the full version of this notice, DE-PS02-09ER09-04, located at: [Grants.gov](http://www.science.doe.gov/grants/Grants.gov)

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

Posted on the Office of Science Grants and Contracts Web Site
October 6, 2008.