

Office of Science
Notice DE-FG01-05ER05-22

*Research and Development
for a Rare Isotope Accelerator*

Department of Energy

**Office of Science Financial Assistance Program Notice
DE-FG01-05ER05-22; Research and Development for a Rare Isotope Accelerator**

AGENCY: U.S. Department of Energy

ACTION: Notice inviting grant applications.

SUMMARY: The Office of Nuclear Physics (NP), Office of Science (SC), U.S. Department of Energy (DOE), hereby announces its interest in receiving applications for Research and Development (R&D) projects directed at a rare isotope accelerator. A next generation facility for nuclear structure and astrophysics is proposed to address emerging research opportunities in low energy nuclear physics, and DOE is sponsoring pre-conceptual R&D activities on the facility.

A companion Program Announcement to DOE Laboratories will be posted on the Office of Science Grants and Contracts web site at <http://www.science.doe.gov/grants/>.

DATES: A Letter-of-Intent, including information on collaborators and a brief summary of proposed research (no more than one-page), is encouraged (but not required) and should be submitted by October 7, 2005, by e-mail directly to the Office of Nuclear Physics at the address listed below.

The deadline for receipt of formal applications is 8 p.m., Eastern Time, Tuesday, October 25, 2005, to be accepted for merit review and to permit timely consideration for award in early Fiscal Year 2006.

ADDRESSES: A Letter-of-Intent referencing Program Notice DE-FG01-05ER05-22 should be sent by e-mail directly to Dr. Blaine Norum at Blaine.Norum@science.doe.gov. Please include the phrase "Rare isotope accelerator R&D Letter of Intent" in the subject line of the e-mail.

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-FG01-05ER05-22 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](http://www.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: Dr. Blaine Norum, Office of Nuclear Physics, SC-26/Germantown Building, Office of Science, U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, D.C. 20585-1290; telephone: (301) 903- 4398; facsimile: (301) 903-3833; e-mail: Blaine.Norum@science.doe.gov. The full text of Program Notice DE-FG01-05ER05-22 is available via the World Wide Web using the following web address: <http://www.science.doe.gov/grants/>.

SUPPLEMENTARY INFORMATION: The nuclear science community has proposed the Rare Isotope Accelerator (RIA) as a new accelerator facility to address emerging research opportunities in nuclear structure, nuclear astrophysics, and fundamental interactions and symmetries. See the DOE/NSF Nuclear Science Advisory Committee's (NSAC) 2002 Long Range Plan available at the following website address: <http://www.science.doe.gov/henp/np/nsac/nsac.html>.

Program Objective:

The Department of Energy is sponsoring pre-conceptual R&D for a rare isotope accelerator. Community sponsored studies and workshops have identified a number of areas where focused R&D and prototyping could enhance performance, reduce costs, and impact the engineering and construction schedule risk for such a facility. Among these areas are:

Beam Simulation:

- Development of end-to-end parallel computing tools for high statistics simulation to optimize the overall system, and to accurately compute beam losses. This R&D is essential to the driver linac technology choice.

Front End:

- Performance of the emittance measurements of the source to feed into linac simulations.
- Demonstration of stable Continuous Wave operation of a Radio Frequency Quadrupole (RFQ), one segment, over a wide power range (factor of 70) needed when going from proton to Uranium.
- Development of the driver ion source to achieve a higher heavy ion current.

Driver Linac:

- Establishment of the performance parameters of strippers, including experiments to measure the scattering and energy loss in the stripper materials.
- Determination of the level of activation and radiation in the second stripper area to see if remote handling is necessary in this area.
- Efforts aimed at concluding cavity development work, including different types of cavities, to provide performance parameters for the end-to-end simulation and ultimately for the choice of the technology.
- Development of transverse and longitudinal diagnostics for the measurement and tuning of the high-power ion beams.
- Study and evaluation of driver linac cost saving schemes, e.g., microphonics reduction schemes and Niobium sputtered structures.
- Development of a beam halo detector for the driver linac.

Isotope-Separator-on-Line (ISOL):

- Optimization of targets, driven by neutrons from a proton to neutron converter, and verification of these results with data obtained from the low-power two-step targets now routinely in operation.
- Development of Resonant Ionization laser ion source and Electron Charge Resonance (ECR) and Electron Beam Ion Source (EBIS) charge breeding, for consideration as techniques for ISOL radioactive ion beams (RIB).
- Comparison of Mercury to molten Lithium as the target material and as the target coolant.
- Development of directly irradiated targets as the interim source of radioactive ion beams before the 2-stage source is commissioned.

Fragment Separation-for Fragment Separators:

- Development of fragment separator simulation codes for the collection, separation, and stopping process, including the process to verify these codes.

- Evaluation of beam dumps including: simulations of the beam dump locations; beam power and power densities for various production scenarios; and power requirements of collimator slits and magnet liners for a range of production scenarios and failure modes.
- Evaluation of high-power fragmentation targets including: stability of windowless liquid lithium at power densities for 1-mm diameter uranium beams at 400MeV/u with minimum powers of 100-kW; and target scenarios for lower Z beams.
- Simulations to characterize radiation doses to magnets and other components near the production targets and beam dumps, and development of appropriate containment for activated coolants such as liquid lithium and water.
- Development of magnet design concepts that are consistent with the radiation doses calculated above and the field and aperture requirements set by the optics calculations.
- Development of concepts for remote handling/maintenance that may be required for radiation damaged and activated magnets and other components.

Fragment Separation-for Gas Cell:

- Determination by detailed simulations the limitations of the range bunching technique and the optimum energies for range bunching and overall production yields.
- Evaluation of the matching of the separator, gas cell, and post acceleration stages.
- Evaluation of intensity limitations and efficiency of the gas cell, and explore options to increase the efficiency and/or reduce space charge effects in the cell.
- Exploration of alternative gas cell geometries that have promise to increase the overall efficiency of the system and investigate possible alternative catchers for very high intensities or specific ions species.

Post Acceleration:

- Evaluation of technical and performance issues with combined 15-Tesla solenoid and super-conducting resonator unit.
- Evaluation of the properties of a high-resolution isobar-separator in terms of tolerances and technical feasibility.
- Development of beam position monitors for very low intensity secondary radioactive ion beams.
- Fabrication of prototype hybrid RFQ, including testing with full range of rf power, and with beam for $q/A=1/132$.
- Fabrication and testing of prototype super-conducting resonators to demonstrate $E_{peak}=20$ MV/m.
- Assessment of beam dynamics options for focusing low q/A heavy-ion beams.
- Development of high precision beam energy measurement system for secondary beams.

Multi User Considerations:

- Investigation and incorporation of a capability that permits and enhances realistic simultaneous independent RIB experiments.
- Conceptual study of beam splitting with variable intensity on several targets for effective multi-user operation; develop equipment to support this scheme.

- Development of an algorithm to assess the overall reliability and availability of the facility, based on mean-time between failures and mean-time for repair models, and evaluate engineering options to include redundancy and to reduce unscheduled shutdowns.

Further details on these areas for R&D aimed at a rare isotope accelerator can be found in the Report of the 2003 RIA R&D Workshop at the following website:

<http://www.science.doe.gov/henp/np/program/riard.htm>.

Additional information on the concept, elements and R&D issues of RIA are outlined in the NSAC ISOL Taskforce Report that can be found at: <http://www.science.doe.gov/henp/np/>. Select the NSAC button.

Applications requesting support for research and development in one or more of the areas outlined above should indicate a separate task for each area. Applications may include more than one task. For each task the application should address the goal of the effort; the method or approach to be taken; a cost-breakdown of the effort; the manpower to carry out the effort; the deliverable result of the work; and the performance, cost, or schedule benefit for a rare isotope accelerator. Each task should describe a realistic schedule which includes a minimum of one milestone per quarter. Applicants should note that they will be required to report formally on a quarterly basis regarding R&D expenditures and progress towards achieving the milestones and deliverables of the proposed effort. Institutional contributions to the effort should be clearly indicated.

Program Funding

It is anticipated that up to \$4,000,000 will be available for multiple awards to be made in Fiscal Year 2006, in the areas described above, contingent on the availability of appropriated funds. It is anticipated that project selection will be completed by March 1, 2006. Applications should be for one year, with a continuation of up to two additional years possible for those tasks requiring a multi-year effort. For continuation of multi-year effort, out-year support is contingent on the availability of funds, progress of the research and programmatic needs. The number of awards will be determined by the number of excellent applications received and the total funds available for this program. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted.

Collaboration

Applicants are encouraged to collaborate with researchers in other institutions, such as: universities, industry, non-profit organizations, federal laboratories and Federally Funded Research and Development Centers (FFRDCs), including the DOE National Laboratories, where appropriate, and to include cost sharing and/or consortia wherever feasible. All collaborators should be listed with the abstract or summary. Additional information on collaboration is available in the Application Guide for the Office of Science Financial Assistance Program that is available via the World Wide Web at: <http://www.science.doe.gov/grants/Colab.html>.

Submission Information

(PLEASE NOTE INFORMATION BELOW ON PAGE LIMITS AND CONTENT)

Information about the development and submission of applications, eligibility, limitations, evaluation, selection process, and other policies and procedures are contained in 10 CFR Part 605, and in the Application Guide for the Office of Science Financial Assistance Program. Electronic access to the latest version of the Office of Science's Financial Assistance Guide and required forms is made available via the World Wide Web at:

<http://www.science.doe.gov/grants/>. DOE is under no obligation to pay for any costs associated with the preparation or submission of applications if an award is not made.

The research project description **must be five pages per task or less**, exclusive of attachments, and must contain an abstract or summary of the proposed research. All collaborators should be listed with the abstract or summary. Attachments include curriculum vitae, a listing of all current and pending federal support and letters of intent when collaborations are part of the proposed research. Curriculum vitae should be limited to no more than two pages per individual.

Merit Review

Applications will be subjected to scientific merit review (peer review) and will be evaluated against the following evaluation criteria, which are listed in descending order of importance as codified at 10 CFR Part 605.10(d):

1. Scientific and/or Technical Merit of the Project,
2. Appropriateness of the Proposed Method or Approach,
3. Competency of Applicant's Personnel and Adequacy of Proposed Resources,
4. Reasonableness and Appropriateness of the Proposed Budget.

The evaluation will include program policy factors, such as the relevance of the proposed research to the terms of the announcement and agency's programmatic needs. External peer reviewers are selected with regard to both their scientific expertise and the absence of conflict-of-interest issues. Non-federal reviewers may be used, and submission of an application constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

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
Science Programs Support Division
Office of Science

Posted on the Office of Science Grants and Contracts Web Site
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