

**Program Announcement  
To DOE National Laboratories  
LAB 05-22**

***Research and Development  
for a Rare Isotope Accelerator***

**SUMMARY:** The Office of Nuclear Physics (NP), Office of Science (SC), U.S. Department of Energy (DOE), hereby announces interest in receiving proposals 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.

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>.

**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 proposals 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 Announcement LAB 05-22 should be sent by e-mail directly to Dr. Blaine Norum at [Blaine.Norum@science.doe.gov](mailto: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 proposals, referencing Program Announcement LAB 05-22, should be sent to: U.S. Department of Energy, Office of Science, Office of Nuclear Physics, SC- 26/Germantown Building, 1000 Independence Avenue, SW, Washington, D.C. 20585- 1290, ATTN: Program Announcement LAB 05-22.

When submitting proposals by U.S. Postal Service Express Mail, any commercial mail delivery service, or when hand carried by the researcher, the following address must be used: U.S. Department of Energy, Office of Science, Office of Nuclear Physics, SC-26, 19901 Germantown Road, Germantown, MD 20874-1290, ATTN: Program Announcement LAB 05-22.

**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 Announcement LAB 05-22 is available via the World Wide Web using the following web site address: <http://www.science.doe.gov/grants/grants.html>.

## **SUPPLEMENTARY INFORMATION**

### **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 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.

Proposals requesting support for research and development in the areas outlined above should indicate a separate task for each area. Proposals may include more than one task. For each task the proposal 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. Proposers 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.

**Collaboration**

Proposers 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. 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>.

## **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. Proposals should be for one year, with a continuation of up to two additional years 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 proposals 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 proposals submitted.

## **Formal Proposals**

The research project description must be 5 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.

The instructions and format described below should be followed. Reference Program Announcement LAB 05-22 on all submissions and inquiries about this program.

### **OFFICE OF SCIENCE GUIDE FOR PREPARATION OF SCIENTIFIC/TECHNICAL PROPOSALS TO BE SUBMITTED BY NATIONAL LABORATORIES**

Proposals from National Laboratories submitted to the Office of Science (SC) as a result of this program announcement will follow the Department of Energy Field Work Proposal process with additional information requested to allow for scientific/technical merit review. The following guidelines for content and format are intended to facilitate an understanding of the requirements necessary for SC to conduct a merit review of a proposal. Please follow the guidelines carefully, as deviations could be cause for declination of a proposal without merit review.

#### **1. Evaluation Criteria**

Proposals will be subjected to formal merit review (peer review) and will be evaluated against the following criteria which are listed in descending order of importance:

Scientific and/or technical merit of the project

Appropriateness of the proposed method or approach

Competency of the personnel and adequacy of the proposed resources

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, the uniqueness of the proposer's capabilities, and demonstrated usefulness of the research for proposals in other DOE Program Offices as evidenced by a history of programmatic support directly related to the proposed work.

## **2. Summary of Proposal Contents**

- Field Work Proposal (FWP) Format (Reference DOE Order 5700.7C) (DOE ONLY)
- Proposal Cover Page
- Table of Contents
- Abstract
- Narrative
- Literature Cited
- Budget (DOE Form 4620.1) and Budget Explanation
- Other Support of Investigator(s)
- Biographical Sketch(es)
- Description of Facilities and Resources
- Appendix

### **2.1 Number of Copies to Submit**

An original and seven copies of the formal proposal/FWP must be submitted.

## **3. Detailed Contents of the Proposal**

Proposals must be readily legible, when photocopied, and must conform to the following three requirements: the height of the letters must be no smaller than 10 point with at least 2 points of spacing between lines (leading); the type density must average no more than 17 characters per inch; the margins must be at least one-half inch on all sides. Figures, charts, tables, figure legends, etc., may include type smaller than these requirements so long as they are still fully legible.

### **3.1 Field Work Proposal Format (Reference DOE Order 5700.7C) (DOE ONLY)**

The Field Work Proposal (FWP) is to be prepared and submitted consistent with policies of the investigator's laboratory and the local DOE Operations Office. Additional information is also requested to allow for scientific/technical merit review. Laboratories may submit proposals directly to the SC Program office listed above. A copy should also be provided to the appropriate DOE operations office.

### **3.2 Proposal Cover Page**

The following proposal cover page information may be placed on plain paper. No form is required.

Title of proposed project  
SC Program announcement title  
Name of laboratory  
Name of principal investigator (PI)  
Position title of PI  
Mailing address of PI  
Telephone of PI  
Fax number of PI  
Electronic mail address of PI  
Name of official signing for laboratory\*  
Title of official  
Fax number of official  
Telephone of official  
Electronic mail address of official  
Requested funding for each year; total request  
Use of human subjects in proposed project:  
    If activities involving human subjects are not planned at any time during the proposed project period, state "No"; otherwise state "Yes", provide the IRB Approval date and Assurance of Compliance Number and include all necessary information with the proposal should human subjects be involved.  
Use of vertebrate animals in proposed project:  
    If activities involving vertebrate animals are not planned at any time during this project, state "No"; otherwise state "Yes" and provide the IACUC Approval date and Animal Welfare Assurance number from NIH and include all necessary information with the proposal.  
Signature of PI, date of signature  
Signature of official, date of signature\*

\*The signature certifies that personnel and facilities are available as stated in the proposal, if the project is funded.

### **3.3 Table of Contents**

Provide the initial page number for each of the sections of the proposal. Number pages consecutively at the bottom of each page throughout the proposal. Start each major section at the top of a new page. Do not use unnumbered pages and do not use suffixes, such as 5a, 5b.

### **3.4 Abstract**

Provide an abstract of no more than 250 words. Give the broad, long-term objectives and what the specific research proposed is intended to accomplish. State the hypotheses to be tested. Indicate how the proposed research addresses the SC scientific/technical area specifically described in this announcement.

### 3.5 Narrative

The narrative comprises the research plan for the project and is limited to 5 pages per task. It should contain the following subsections:

**Background and Significance:** Briefly sketch the background leading to the present proposal, critically evaluate existing knowledge, and specifically identify the gaps which the project is intended to fill. State concisely the importance of the research described in the proposal. Explain the relevance of the project to the research needs identified by the Office of Science. Include references to relevant published literature, both to work of the investigators and to work done by other researchers.

**Preliminary Studies:** Use this section to provide an account of any preliminary studies that may be pertinent to the proposal. Include any other information that will help to establish the experience and competence of the investigators to pursue the proposed project. References to appropriate publications and manuscripts submitted or accepted for publication may be included.

**Research Design and Methods:** Describe the research design and the procedures to be used to accomplish the specific aims of the project. Describe new techniques and methodologies and explain the advantages over existing techniques and methodologies. As part of this section, provide a tentative sequence or timetable for the project.

**Subcontract or Consortium Arrangements:** If any portion of the project described under "Research Design and Methods" is to be done in collaboration with another institution, provide information on the institution and why it is to do the specific component of the project. Further information on any such arrangements is to be given in the sections "Budget and Budget Explanation", "Biographical Sketches", and "Description of Facilities and Resources".

### 3.6 Literature Cited

List all references cited in the narrative. Limit citations to current literature relevant to the proposed research. Information about each reference should be sufficient for it to be located by a reviewer of the proposal.

### 3.7 Budget and Budget Explanation

A detailed budget is required for the entire project period, which normally will be three years, and for each fiscal year. It is preferred that DOE's budget page, Form 4620.1 be used for providing budget information\*. Modifications of categories are permissible to comply with institutional practices, for example with regard to overhead costs.

A written justification of each budget item is to follow the budget pages. For personnel this should take the form of a one-sentence statement of the role of the person in the project. Provide a detailed justification of the need for each item of permanent equipment. Explain each of the other direct costs in sufficient detail for reviewers to be able to judge the appropriateness of the amount requested.

Further instructions regarding the budget are given in section 4 of this guide.

\* Form 4620.1 is available at web site: <http://www.science.doe.gov/grants/Forms-E.html>.

### **3.8 Other Support of Investigators**

Other support is defined as all financial resources, whether Federal, non-Federal, commercial or institutional, available in direct support of an individual's research endeavors. Information on active and pending other support is required for all senior personnel, including investigators at collaborating institutions to be funded by a subcontract. For each item of other support, give the organization or agency, inclusive dates of the project or proposed project, annual funding, and level of effort devoted to the project.

### **3.9 Biographical Sketches**

This information is required for senior personnel at the institution submitting the proposal and at all subcontracting institutions (if any). The biographical sketch is limited to a maximum of **two pages** for each investigator.

### **3.10 Description of Facilities and Resources**

Describe briefly the facilities to be used for the conduct of the proposed research. Indicate the performance sites and describe pertinent capabilities, including support facilities (such as machine shops) that will be used during the project. List the most important equipment items already available for the project and their pertinent capabilities. Include this information for each subcontracting institution, if any.

### **3.11 Appendix**

Include collated sets of all appendix materials with each copy of the proposal. Do not use the appendix to circumvent the page limitations of the proposal. Information should be included that may not be easily accessible to a reviewer.

Reviewers are not required to consider information in the Appendix, only that in the body of the proposal. Reviewers may not have time to read extensive appendix materials with the same care as they will read the proposal proper.

The appendix may contain the following items: up to five publications, manuscripts (accepted for publication), abstracts, patents, or other printed materials directly relevant to this project, but not generally available to the scientific community; and letters from investigators at other institutions stating their agreement to participate in the project (do not include letters of endorsement of the project).

## **4. Detailed Instructions for the Budget**

(DOE Form 4620.1 "Budget Page" may be used)

#### **4.1 Salaries and Wages**

List the names of the principal investigator and other key personnel and the estimated number of person-months for which DOE funding is requested. Proposers should list the number of postdoctoral associates and other professional positions included in the proposal and indicate the number of full-time-equivalent (FTE) person-months and rate of pay (hourly, monthly or annually). For graduate and undergraduate students and all other personnel categories such as secretarial, clerical, technical, etc., show the total number of people needed in each job title and total salaries needed. Salaries requested must be consistent with the institution's regular practices. The budget explanation should define concisely the role of each position in the overall project.

#### **4.2 Equipment**

DOE defines equipment as "an item of tangible personal property that has a useful life of more than two years and an acquisition cost of \$25,000 or more." Special purpose equipment means equipment which is used only for research, scientific or other technical activities. Items of needed equipment should be individually listed by description and estimated cost, including tax, and adequately justified. Allowable items ordinarily will be limited to scientific equipment that is not already available for the conduct of the work. General purpose office equipment normally will not be considered eligible for support.

#### **4.3 Domestic Travel**

The type and extent of travel and its relation to the research should be specified. Funds may be requested for attendance at meetings and conferences, other travel associated with the work and subsistence. In order to qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Consultant's travel costs also may be requested.

#### **4.4 Foreign Travel**

Foreign travel is any travel outside Canada and the United States and its territories and possessions. Foreign travel may be approved only if it is directly related to project objectives.

#### **4.5 Other Direct Costs**

The budget should itemize other anticipated direct costs not included under the headings above, including materials and supplies, publication costs, computer services, and consultant services (which are discussed below). Other examples are: aircraft rental, space rental at research establishments away from the institution, minor building alterations, service charges, and fabrication of equipment or systems not available off-the-shelf. Reference books and periodicals may be charged to the project only if they are specifically related to the research.

##### **a. Materials and Supplies**

The budget should indicate in general terms the type of required expendable materials and supplies with their estimated costs. The breakdown should be more detailed when the cost is substantial.

#### **b. Publication Costs/Page Charges**

The budget may request funds for the costs of preparing and publishing the results of research, including costs of reports, reprints page charges, or other journal costs (except costs for prior or early publication), and necessary illustrations.

#### **c. Consultant Services**

Anticipated consultant services should be justified and information furnished on each individual's expertise, primary organizational affiliation, daily compensation rate and number of days expected service. Consultant's travel costs should be listed separately under travel in the budget.

#### **d. Computer Services**

The cost of computer services, including computer-based retrieval of scientific and technical information, may be requested. A justification based on the established computer service rates should be included.

#### **e. Subcontracts**

Subcontracts should be listed so that they can be properly evaluated. There should be an anticipated cost and an explanation of that cost for each subcontract. The total amount of each subcontract should also appear as a budget item.

### **4.6 Indirect Costs**

Explain the basis for each overhead and indirect cost. Include the current rates.