Announcement of Opportunity

Investigations into Biological Effects of Radiation Using the GSI Accelerator Facility

AO-2017-IBER

Letters of Intent due: 15.09.2017

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Proposals due: 27.10.2017

European Space Agency
Agence spatiale européenne

Summary of the AO for Investigations into Biological Effects of Radiation:

- The Directorate of Human Spaceflight and Robotic Exploration of the European Space Agency announces an opportunity to propose investigations into biological effects of space radiation.

- Experiments will be performed using the GSI accelerator facility in Darmstadt, Germany (http://www.gsi.de)

- Experiments should contribute to improved risk assessments or study countermeasures to allow a safe and stable human exploration of, e.g., the Moon or Mars with acceptable risk from exposure to space radiation

- Eligibility: The scientific institution for which the coordinator of a proposal is working must be located in one of the ESA member or associated member states that contribute to the SciSpace programme: **Austria, Belgium, Czech Republic, Denmark, France, Germany, Ireland, Italy, Norway, Poland, Romania, Spain, Sweden, Switzerland, United Kingdom**. Scientists from ESA Member States that do not contribute to the SciSpace Programme and scientists from other European countries having a cooperation agreement with ESA, are encouraged to enquire with their national space organisation about the conditions for their participation in proposals to ESA.

- Submission of Letter of Intent and proposals will be done electronically. The proposal must use the template from the AO website. Both, Letter of Intent and proposals must be sent to the announcement-specific email address before the respective deadlines.

- Important dates:
  - **Letter of Intent due 15.09.2017**
  - **Proposal workshop (at GSI, Darmstadt, Germany) 26.09.2017**
  - **Proposals due 27.10.2017**

- For questions related to this Announcement of Opportunity please contact:

ESA/ESTEC/HRE-UL
Dr. med., Dr. rer. nat. Thu Jennifer Ngo-Anh
Announcement-specific Email: radbio@esa.int

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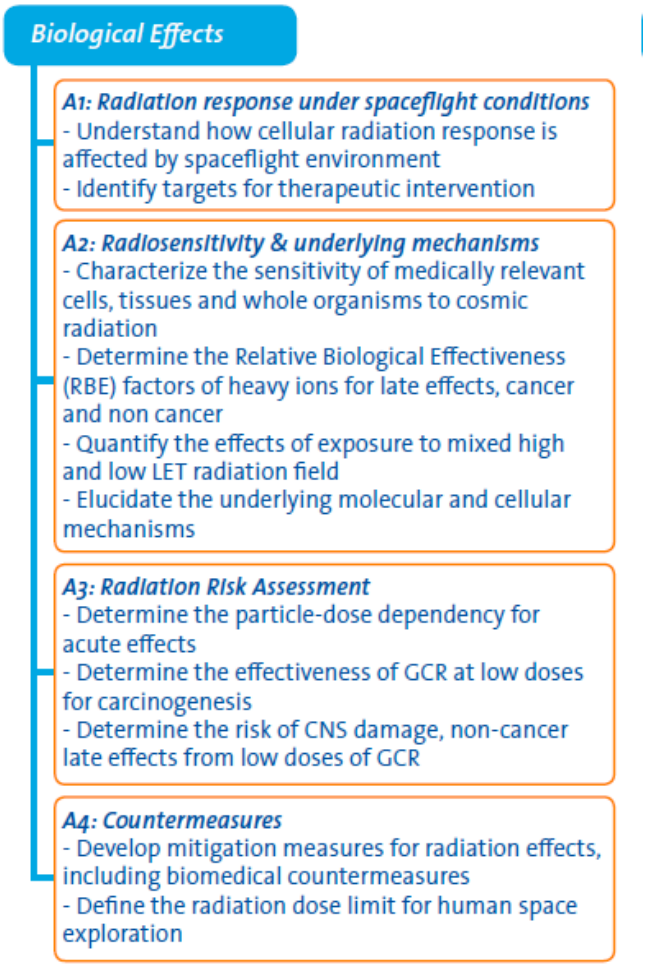
1 BACKGROUND

Cosmic radiation is considered the main health hazard for human exploration and colonization of the solar system: crewmembers may be exposed to different doses and qualities of radiation, threatening life quality and individual survivability, thereby disrupting mission success. This creates a need for investigations into biological effects of space radiation, in order to allow more accurate risk assessments, which in turn leads to more accurate planning of countermeasures.
To address these issues, biological experiments at particle accelerator facilities are of great use, which is why ESA's Human Research Office has been cooperating with the GSI Helmholtz Center for Heavy Ion Research in Darmstadt since 2007, making mostly use of its SIS18 synchrotron (high-energy accelerator) in Cave A. Since the beginning of ESA's cooperation with GSI, 2 research announcements were released (AO-IBER-2008 and AO-IBER-2010), a total of 25 experiments were implemented over a period of four years.
ESA plans to continue to advance knowledge on quantifying the risks and actual exposures to radiation in space to allow developing effective countermeasure strategies to protect crewmembers from the damaging effects of space radiation.

2 ANNOUNCEMENT OBJECTIVES

ESA announces an opportunity to propose investigations into biological effects of space radiation using the accelerator facility of the GSI. Experiments should contribute to improved risk assessments or study countermeasures on cells or animals to allow safe and stable human space exploration with acceptable risk from exposure to space radiation:

The radiation risk is characterized by a high uncertainty and lack of simple countermeasures. Most of the uncertainty on space radiation risk is associated with the poor knowledge of the biological effects of cosmic rays. This includes interaction of radiation damage with the effects of other space environment stressors, relative biological effectiveness (RBE) factors for energetic heavy ions for late effects, errors in human data including statistical, dosimetry and transfer between populations in application to space risks, effects of exposure to mixed high and low LET space radiation and the dose response curve at low radiation doses.
Therefore, the objectives stated in the ESA roadmap for Radiation research (developed together with the European science community during the Research Community Consultation Workshop in January 2016) will address these points through experimental studies. The data to be obtained shall improve the models, which are necessary for a correct radiation risk assessment. In addition to supporting the needs of Human Space Exploration missions the information obtained is relevant to assessment of terrestrial risks due to low dose ionizing radiation exposure and improvement of charged particle therapy in oncology. The following table provides more detail on each of these topics:



Specifically, three major relevant research areas have been recently identified through an independent expert group. Scientists answering to this Announcement of Opportunity must indicate which of the three areas is addressed by their proposal:

- To provide quantitative estimates of the dose- and dose-rate dependence of the risk for radiation-induced acute and late morbidity, including cancer and non-cancer effects

- To identify, develop and validate early biomarkers of risk for ensuing radiation-induced health detriment

- To identify, develop and validate biomedical and physical countermeasures, including the potential impact of individual susceptibility.

Scientists working in rapidly developing areas of life sciences not necessarily associated with the study of radiation should consider the contributions that their field of study can make and to propose relevant investigations. However, investigators new to heavy-ion effects or radiation research in general are encouraged to consult or collaborate with radiation experts in order to develop realistic experimental plans.

3 THE GSI ACCELERATOR FACILITY

3.1 Facility Description

GSI operates a large, in many aspects worldwide unique accelerator facility for heavy-ion beams. Ions from H to U can be accelerated to energies between 3 MeV/n to 2 GeV/n with intensities above those required for radiobiological research. Within this Announcement of Opportunity, GSI makes available the high-energy SIS-18 accelerator, which accelerates particles from H to U up to 2 GeV/n. Radiobiology laboratories are available, which are standard cell laboratories for research on cultured cells, DNA laboratory and a microscopy laboratory. Information about this facility is available at the webpage http://www.gsi.de. For further information on GSI facilities please contact Ulrich Weber: u. weber@gsi.de.

3.2 Specific Requirements for Biological Experiments at GSI

Please note that regulations at GSI allow only experiments with no genetically modified organisms (safety level 1). All persons entering the GSI laboratories must comply with yearly updated biosafety instructions (certified by signature) in addition to the general GSI safety procedures. Activities with cytostatica require special safety instructions.
To avoid any cross-contaminations, anyone who is bringing a cell culture to GSI must have it certified as "mycoplasma free" (by PCR or ELISA) not more than one month prior to the run. The testing should not be done in house but by a certified laboratory, e.g. by DSMZ (www.dsmz.de). Mycoplasma-free conditions should be stated in English.
Radiobiological experiments involving the use of radioactive materials are not allowed at GSI.
Persons intending to perform safety-relevant work at GSI are required to possess advanced English skills for communication (e.g. corresponding to 220 TOEFL-scoring (computer-based) or level 6 of IELTS. No exam result needs to be presented.)
For further information on biological facilities at GSI and safety issues please contact a.schott@gsi.de.

4 PROPOSAL EVALUATION AND SELECTION PROCEDURES

In line with the standard evaluation process of ESA, the evaluation of the proposals will cover three aspects: scientific merit, relevance and feasibility.

4.1 Scientific Merit Review

Programme-compliant proposals submitted in response to this AO will undergo a scientific merit (peer) review. Only those proposals most highly rated in the merit review process will undergo the additional review for feasibility.
All of the following criteria will be used in determining the merit score:

Significance: Does this study address an important problem? If the aims of the application are achieved, how will scientific knowledge or technology be advanced? What will be the effect of these studies on the concepts, methods, or products that drive this field?

Approach: Are the theoretical framework, experimental design, data analysis and interpretation methods adequately developed, well integrated, and appropriate to the aims of the project? Is the proposal hypothesis-driven? Is the proposed approach likely to yield the desired results? Does the applicant acknowledge potential problem areas?

Innovation: Does the project employ novel concepts, approaches, or methods? Are the aims original and innovative? Does the project challenge existing paradigms or develop new methodologies or technologies?

Personnel: Are the scientific personnel appropriately trained and well suited to carry out this work? Is the evidence of the personnel's productivity satisfactory? Are the functions and responsibilities of the team members adequately described and appropriate? Does the project employ useful collaborative arrangements?

Environment: Does the institutional environment, in which the work will be performed, contribute to the probability of success?

In the review, each proposal will receive a scientific merit score between 0 and 100 points. As a result of the scoring the proposals will receive one of the following marks:

- Outstanding 100 - 91 points
- Excellent 90 - 81 points
- Very Good 80 - 71 points
- Good to Fair 70 - 46 points
- Unacceptable 45 - 0 points

The scoring will be weighted according to the 5 sub-criteria:

- Significance 30%
- Approach 25%
- Innovation 20%
- Personnel 15%
- Environment 10%

4.2 Relevance Score

The peer board will also evaluate the proposal's relevance to space radiation research in line with the topics and characteristics described above. Again, scores between 0 – 100 will be given, resulting in a second mark.

4.3 Evaluation of Feasibility and Selection Recommendation

The most highly rated proposals following the peer review will undergo a feasibility evaluation. This evaluation will also take into account the overall resources available for ESA-solicited experiments (up to 20 shifts of beamtime in 2018 and 2019).
The results from the scientific merit evaluation, the space radiation research relevance and the conclusions on the feasibility of the proposals, with support by ESA's advisory bodies, will be used in the development of ESA's selection recommendation to its relevant Programme Board (PB-HME).
ESA reserves the right to select only a part of a proposed project if this portion is still of high scientific merit. The applicant will be given the choice to accept or decline such a partial opportunity. If two or more proposals address similar problems and/or adopt similar approaches, it may be requested that the science teams consolidate specific parts of their projects into a single project and work as one team.
The selected experiments are foreseen to be implemented within two years, namely towards the second half of 2018 and 2019 respectively.

4.4 Data Rights

4.4.1 General

The general data policies of ESA's Directorate for Human Spaceflight and Robotic Exploration will apply to all data resulting from the experiments in the context of this AO.
Final results of the studies shall be made available by the scientific teams to the scientific community through publication in appropriate journals or other established channels as soon as practicable and consistent with good scientific practice. In the event such reports or publications are copyrighted, ESA shall have a royalty-free right under the copyright to reproduce, distribute, and use such copyrighted work for their purposes.

4.4.2 Practical implementation of data policies

Typically, data will be obtained and processed under the responsibility of a Science Team Coordinator (STC) for the experiment protocol. Data not requested by any other STC may be used exclusively by the STC for scientific purposes. For data requested by more than one STC, each STC must agree before the experiments start as to the conditions for the data usage for scientific purposes. This category of data shall be referred to as "STC proprietary data." The STC proprietary data may be used by the sponsoring agencies for internal purposes. The sponsoring agencies agree that this data will not be made public for 1 year after the completion of the experiment.
In case follow-up points are required for publication long after the main experiment, a STC can apply for extension of the one-year exclusive publication period by submitting a scientific report in the format of a manuscript 1 year after the completion of the main experiment.

4.4.3 Data Access

A STC may access proprietary data from other STCs participating in the investigations through a written data sharing agreement (signed by involved STCs). In that case, ESA will ensure that a data-sharing plan among the participating STCs is established prior to the beginning of the respective experiments.

4.4.4 The Erasmus Experiment Archive (EEA)

The EEA is an ESA service within the Human Spaceflight and Robotic Exploration Directorate to the international scientific community. Abstracts, from all European microgravity experiments performed to date are collected in this database. Experimenters sponsored by ESA have the obligation to provide these abstracts themselves. Special emphasis is placed on the completeness of the list of references of articles where the experiment results can be found.
The database includes a full-text search capability to retrieve information on experiments in a certain discipline, subject, mission, or by investigator name. The EEA covers both physical and life sciences, and can be found at the following URL:

http://spaceflight.esa.int/eea/

This database includes also a large number of pictures, as well as video sequences documenting experiment abstracts.
Scientists in Europe who have performed experiments, be it in orbiting or ground- based facilities are requested to either provide an abstract on each of their experiments, or to provide information enabling the updating of their existing abstracts, in particular the list of articles published.

4.4.5 Acknowledgement

Any publication on the results generated during the studies solicited in this AO must acknowledge the sponsorship of the study by ESA.

4.4.6 Support of Education and Outreach

The activities covered in this AO provide an opportunity for ESA to enhance and broaden the public's understanding and appreciation of research facilitated by ESA's Human Spaceflight and Robotic Exploration Directorate. Therefore the investigators of selected experiments are expected to promote and communicate their experiments to a wide audience (general public, colleagues, involvement of students) and to support ESA in the event of organised press conferences, educational events, publications etc.

5 PROPOSAL PREPARATION GUIDE

5.1 Contact and Submission Address

For questions related to this Announcement of Opportunity please contact:

ESA/ESTEC/HRE-UL
Dr. med., Dr. rer. nat. Thu Jennifer Ngo-Anh
Announcement-specific Email: radbio@esa.int

Proposals should be submitted in electronic format AS ONE SINGLE FILE (Microsoft Word (.doc) or Adobe Acrobat (.pdf)) to the above email address.
The Letter of Intent, questions, and other files concerning the AO should also be emailed to this address.
To facilitate transmission of the file the total file size should be no more than 5 MB (incl. pictures). Whenever signatures are required on a form, the completed, signed form should be scanned and inserted into the proposal file.
Your submission will be acknowledged within 10 working days of receipt.
It is planned to organise a proposal workshop in connection to this research announcement on 26.09.2017. The workshop will take place at the GSI, Planckstrasse 1, 64291 Darmstadt. This will be an opportunity to clarify potential questions or gather contacts for cooperative research projects. Please indicate your interest in participating in this workshop together with the Letter of Intent to the abovementioned contact email by 15.09.2017, for planning, registration and logistical information distribution purposes, mentioning names and affiliations of all persons intending to join the workshop.

5.2 Time Schedule

- Letter of Intent due 15.09.2017
- Proposal workshop (at GSI, Darmstadt, Germany) 26.09.2017
- Proposals due 27.10.2017

5.3 Letter of Intent

To facilitate timely proposal processing (e.g. organisation of peer review), potential investigators are requested to confirm their plans to submit a proposal in response to this announcement. The Letter of Intent is neither mandatory nor binding. It should contain:

- the names, addresses, affiliations and telephone numbers of a single STC and all Science Team Members (STMs).
- a title descriptive of the proposed research.
- a brief summary (10 lines maximum) describing the proposed research.

Letters of Intent are to be sent to the following address: radbio@esa.int
The Letters of Intent will be distributed to the participants of the proposal workshop, to facilitate cooperation. Therefore no critical information (e.g. unpublished data) should be included.
A template for the Letter of Intent can be found on the announcement website.

5.4 Proposals and Funding

The proposal should be written in the format described below, using the template downloadable on the AO website. This format is not intended to increase the "paper work" but should be considered as a useful guideline, which will permit a fair and standardized evaluation of the proposals. Also, due to specific facility safety and other regulations, adequate responses to the respective questions in the proposal template are mandatory for consideration of the proposals.
Beamtime and access to local laboratories and support will be provided by GSI (with ESA support) in line with the usual GSI operation. However, neither ESA nor GSI financially support the work of selected experimenters. Any additional expenses related to the proposed work of an experimenter, including costs for travel and subsistence, are considered investigator-related costs, which are not sponsored by ESA. Co-funding from national agencies / organisations, universities, or other institutions is required to cover investigator-related costs. ESA strongly advises science teams to submit their proposal to their national bodies in parallel with their application in response to this AO, in order to commence applying for national funding as early as possible. If the proposed experiment is selected a proof of appropriate funding is mandatory in order to start preparation and implementation.
Please state the status of co-funding availability and/or application in "Supporting Budgetary Information".

5.5 Structure and Layout

The proposal, using the template from the AO website, should include the following material in this order:

- Cover Page with signature
- Proposal Abstract
- Project Description
- Management Approach and Personnel
- Supporting Budgetary Information
- Facilities and Equipment
- Safety

5.5.1 Cover Page

The proposal template from the AO website includes the standard cover page form. All information asked for must be filled in.

5.5.2 Proposal Abstract

Prepare a brief description of the application stating the broad, long-term objectives and specific aims of the proposed work. Describe concisely the research design and methods for achieving these objectives and aims. This abstract is meant to serve as a succinct and accurate description of the proposed work when separated from this application. Limit abstract to 300 words or less.

5.5.3 *Project Description*

The project description section of the proposal should not exceed 20 pages using regular (12 point) font. The proposal should contain sufficient detail to enable a reviewer to make informed judgements about the overall merit of the proposed research and about the probability that the investigators will be able to accomplish their stated objectives with the resources requested and with their own resources. In addition, the proposal should indicate clearly the relationship between the proposed work and the research emphasis defined in this announcement.
Proposers are encouraged to describe any preparatory research from their laboratory relevant to the proposal.

5.5.4 *Management Approach and Personnel*

Each proposal must specify a single Scientific Team Coordinator, who is responsible for carrying out the proposed project and coordinating the work of other personnel involved in the project. The scientific institution for which the coordinator of a proposal is working must be located in one of the ESA member or associated member states that contribute to the SciSpace programme: **Austria, Belgium, Czech Republic, Denmark, France, Germany, Ireland, Italy, Norway, Poland, Romania, Spain, Sweden, Switzerland, United Kingdom**. Scientists from ESA Member States that do not contribute to the SciSpace Programme and scientists from other European countries having a cooperation agreement with ESA, are encouraged to enquire with their national space organisation about the conditions for their participation in proposals to ESA.
In proposals that designate several senior professionals as key participants in the research project, the management approach section should define the roles and responsibilities of each participant, and note the proportion of each individual's time to be devoted to the proposed research activity. The proposal should state clearly and unambiguously whether the key personnel have reviewed the proposal and endorsed their participation.
Despite the fact that cooperative research proposals are favoured, big clusters of research proposals are not welcome because of the difficulty for the peer reviewers to make their judgement and later on the difficulty of implementation with the other selected protocols.
The STC is the main ESA point of contact for a team and must participate in the conduct of the research. He/she is responsible for direct supervision of the work and efficient communication among STMs.
A short curriculum vitae (not exceeding 3 pages) of the STC, which includes her or his current position, title and educational background, list of principal publications (up to 20), and any exceptional qualifications should be included. Give similar biographical information on other senior professional personnel who will be directly associated with the proposed project. Universities should list students or other assistance involved, together with information as to their level of academic achievements. Any special industry-university cooperative arrangements should be described.

5.5.5 *Supporting Budgetary Information*

Please describe briefly the status of co-funding availability and/or applications.

5.5.6 Facilities and Equipment

Please describe the required beams and supporting equipment, addressing the questions in the proposal template.

5.5.7 Safety

Proposals must be compliant with applicable European, national and local laws and guidelines. Please complete the safety questions in the proposal template. Proposals missing information on this topic will not be accepted.