

Initiating the Development of Measurement Enhancements for the Existing NASA Space Radiation Shielding Consortium

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Abstract—This effort was directed at seeking funding under NASA NRA 03-OBPR-05. The PI submitted a proposal in January, 2004 in response to the NRA for funding to enhance the capabilities of measurements currently funded under existing NASA grants. NASA's Office of Biological and Physical Research (OBPR) has decided to fund efforts in the physics aspects of Space Radiation Research through the mechanism of creating consortia of research groups. To date several of these consortia have been funded. The PI is currently a member of one of the major Space Radiation Shielding Physics Consortia, specifically the group charged with modeling the Space Radiation Environment and, in particular, with developing transport codes to enable that modeling. One of the other major consortia has a mandate to conduct measurements of the physical cross sections needed to support the work of the modeling consortium. The proposal requested funding to study resources

needed to enable the enhancement of the currently funded efforts to enable them to take a wider class of data. This increased measurement capability is essential to the efficient use of the accelerator beam time and will significantly expedite the development of the various transport codes. The intended outcome of this work, long term, was to have been for another major proposal for the construction of a substantially enhanced detector system. Although that proposal was actually not funded, its longer-range goal has occurred anyway, and NASA has issued a subsequent NRA for the exact purposes intended. The PI is a participant on a current major funding proposal to NASA to participate in future measurements.

To date, the PI has obtained five grants totaling more than \$2,100,000 from proposals whose writing was enabled in part by prior ISSO support. In addition, prior ISSO support has resulted in the publication of over 25 papers and presentations worldwide.

THIS ISSO MINI-GRANT SOUGHT FUNDS TO ENABLE THE Principal Investigator and one graduate student to initiate work on a project that was already the subject of a NASA proposal. That proposal was submitted January 15, 2004, in response to NRA 03-OBPR-07. The physics substance of that proposal will not be repeated here, but is simply incorporated by reference. The essence of the proposed research was to conduct an active collaborative study of the enhancements needed in the existing detector systems that are being deployed as part of the current Space Radiation Shielding measurement program.

NASA has chosen to attack the Space radiation issue by creating a number of "consortia," each one being concentrated on a certain area of the overall problem. The first of these was the NSBRI Consortium, headquartered at the Baylor College of Medicine in Houston, Texas. It is concerned specifically with the biomedical aspects of the effects of Space radiation on humans. More recently, NASA created several physics-related consortia under the general moniker of Space Radiation Shielding Consortia. Two of these consortia are specifically targeted respectively at the Measurement and Modeling of the heavy ion cross sections needed to simulate the transport of the constituents of the Space radiation environment through shielding materials. The PI is a member of the "Modeling" consortium.

The originally submitted proposal argued that the existing detector system being employed by the Measurement Consortium is inadequate for the desired task. Further, the existing hardware does not make efficient use of the beam time being paid for by NASA at the NSRL facility or at the AGS at the Brookhaven National Lab. We proposed to conduct an active study of the possible enhancements to that system and to report back with a proposed design for a new or redesigned detector system. It is likely that NASA will have to consider upgrading the detector systems. The estimated cost of such an enhancement is on the order of \$500,000 - \$1,000,000. The ISSO funding request would have enabled the PI and one graduate student to initiate this effort in a timely way and make use of beam time last year for initial studies. Although the original NASA proposal was not funded, its broader goal of moving NASA towards the development of more versatile detectors for use by the measurement consortium has succeeded. In fact, as a result of the ISSO-funded study efforts, the PI was able to participate in the submission of a new proposal under NRA NNH042UU005N to obtain funds to begin the process of detector enhancement.

Over the longer term, the PI intends to pursue the creation of a Radiation Science Center at the University of Houston. Such a Center would include the related efforts currently ongoing at the University of Houston. Funding would add several faculty positions in areas that include the major relevant fields of interest within NASA. Ultimately, the scientific efforts would be divided between several, if not all of NASA's Space Radiation Shielding interests and the interests in the biomedical community in several related areas including radiation oncology and fundamental molecular biology. Some of the time that the PI would gain this summer with the request-

ed support would be devoted to that effort. Indeed, the initial plan for the creation of this Center would include bringing the PI and principal members of the Measurement Consortium to the University of Houston. If that were to occur, then all subsequent funding for the proposed detector enhancement would come through grants to the university. Beyond that, should the Center be fully realized, the annual funding would initially exceed several million dollars, with the ultimate prospect for HIH funding that could conceivably reach levels substantially beyond those totals.

Funding and Proposals

"Analysis of Data from the Mars '01 MARIE Experiment," Aug. 1, 2001–July 31, 2002, NAG9-1347, \$25,894.

"Determining the Radial Dependence of Particle Intensities from Coronal Mass Ejections," Jan. 1, 2002–Dec. 31, 2003, ARP, \$103,000.

"Measurements of Fragmentation Cross Sections and Particle Spectra For Galactic Cosmic Ray-Like Nuclei between 3 and 10 GeV/nucleon at the BNL AGS," submitted in response to NASA NRA NNH042UU005N, fall 2004, with a net request for UH funding of ~\$100,000.

Student Report Related to the ISSO Research

Lebourgeois, M. "Software Development To Support NASA Measurement Effort," B.S. Physics, June 2004–May 2005.