

# Space Radiation Newsletter

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## 16<sup>th</sup> Annual NASA Space Radiation Investigators' Workshop

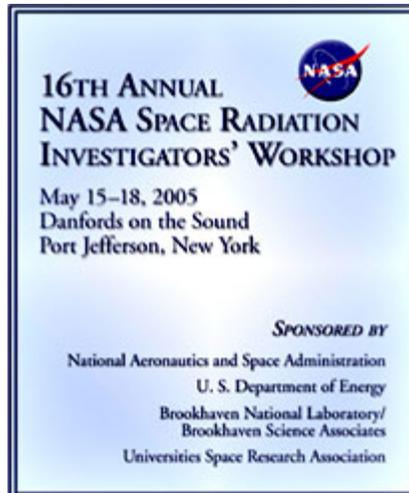
Improving methods to predict and mitigate risks for the development of cancer, cataracts, DNA damage, and neurological damage from ionizing space radiation will be discussed by the space radiation investigators who will convene from May 15-18, 2005 at the 16th Annual NASA Space Radiation Investigators' Workshop in Port Jefferson, New York.

Information on improvements in dosimetry and spacecraft shielding, as well as improvements in radiation transport codes, will also be presented at the Workshop.

Many of the studies to be discussed at the Workshop were performed at the [NASA Space Radiation Laboratory](#), a NASA-dedicated facility housed at the Brookhaven National Laboratory that uses beams that simulate the harmful rays of space radiation.

A special tribute to [Bill Holley](#) who passed away on November 19, 2004 will be presented at the Workshop. Bill spent 22 years in the Life Sciences Division at the Lawrence Berkeley National Laboratory where he is remembered for sharing his knowledge and experience generously and for his warm and cheerful good nature.

The [USRA web site](#) contains additional information about the workshop.



## Managing Lunar and Mars Mission Radiation Risks - Part I

A new NASA Technical Paper, "Managing Lunar and Mars Mission Radiation Risks Part I: Cancer Risks, Uncertainties and Shielding Effectiveness", explores probability distribution functions for cancer risks for human missions to the moon or Mars. The focus of the paper is the development of approaches to manage radiation risks when large uncertainties exist in risk projections models, including defining significance tests for optimizing radiation shielding approaches. Part II will consider management of acute risks from solar particle events, and Part III non-cancer risks including damage to the central nervous system and heart diseases. The [report](#) is available.

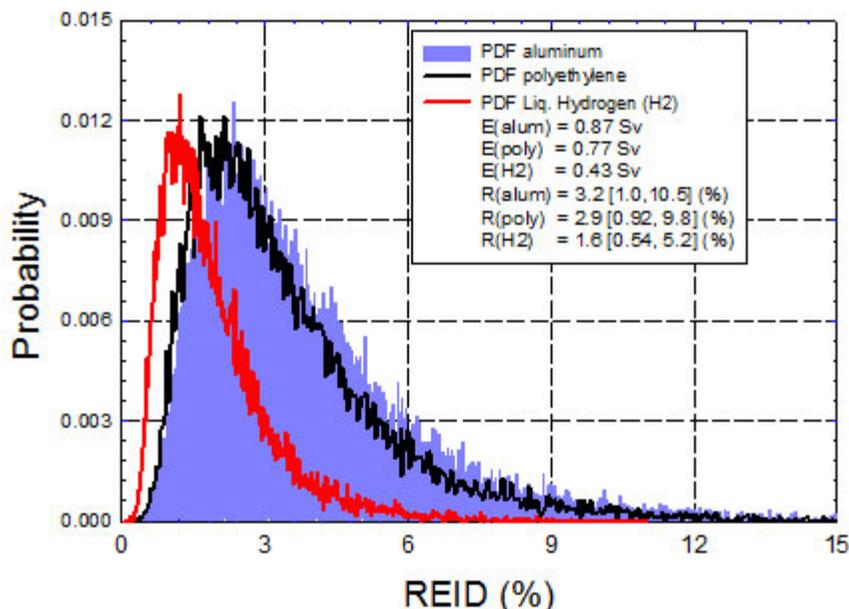


Figure 1. Probability distribution functions (PDF's) for risk of exposure induced death (REID) to 40-y males on 600-day Mars mission behind 20 g/cm<sup>2</sup> shields of aluminum, polyethylene or liquid hydrogen. Effective doses, and point estimates and 95% CI for REID are shown in box.

## New NSCOR Awarded

NASA recently awarded the University of Texas Southwestern Medical Center in Dallas, Texas a five-year, \$9.8 million research grant to identify solid tumor cancer risks from space radiation. The study, entitled "Lung Cancer Pathogenesis and HZE Particle Exposure," will collect data from animal models and tissues at the cellular and molecular level to extrapolate the collected knowledge to humans. Researchers will use the NASA Space Radiation Laboratory at Brookhaven National Laboratory to perform irradiation of the cells and tissues used in their experiments.

UT Southwestern Medical Center is the fifth NASA Specialized Center of Research (NSCOR) established to address the radiation health effects to humans that may be encountered in long duration space flight. Rather than being a grant to an individual, an NSCOR consists of a team of investigators with complementary skills who work closely together to solve a closely focused set of research questions. Eleven proposals were received for the solicitation for proposals on "Estimation of Solid Tumor Cancer Risks."

## 2005 NASA Space Radiation Summer School

Fifteen students will participate in the June 2-24, 2005 NASA Space Radiation Summer School at the Brookhaven National Laboratory (BNL) in Upton, New York. The three-week course will train the students to perform space radiobiology experiments at the NASA Space Radiation Laboratory (NSRL), also housed at the New York laboratory.

The graduate students, postdoctoral research associates, and seasoned research veterans who will form the class of 2005 were selected after an extensive national - and international - recruitment campaign. Some have backgrounds in biology, cancer biology, physiology, and toxicology, while others have studied physics and nuclear engineering.

All students will have the opportunity to venture beyond their comfort zones to learn a combination of physics and radiation biology and to perform accelerator experiments in the NSRL. Lectures on the properties of ionizing radiation, particle accelerators, radiation doses and track structure, radiation chemistry, effects of ionizing radiation on DNA and DNA repair mechanisms, radiation carcinogenesis, and radiation effects on the central nervous system will be presented by the preeminent leaders in the fields. Following the lectures will be ample discussion with the instructors and the opportunity to expand the students' classroom to the NSRL as they irradiate cells and tissues using beams of heavy ions from Brookhaven's accelerator to simulate the heavy ions and cosmic rays found in space.

## SRHP Featured Investigator: Dr. Marco Durante



**Dr. Marco Durante**  
Associate Professor of Physics  
University Federico II

For more than a decade Dr. Marco Durante has developed studies to assess radiation effects on chromosomes and has expanded his interest in astronaut and cosmonaut biodosimetry through collaborations with NASA and the Institute of Biomedical Problems in Moscow.

The main focus of his research is on the cytogenetic effects of heavy ions on mammalian cells. He has implemented techniques such as premature chromosome condensation (PCC) and fluorescence in situ hybridization (FISH) to study the effects of heavy ion exposure. While at the National Institute for Radiological Sciences (NIRS) in Chiba, Japan, he collaborated on the development of a new technique of premature chromosome condensation based on the use of phosphatase inhibitors. This technique is now widely used for studying radiation-induced effects at the chromosomal level.

Dr. Durante is an expert in the use of multicolor chromosome painting technique and in its application for the analysis of genetic effects of heavy ions.



In 2000, while working as a visiting scientist at NASA's Johnson Space Center, Dr. Durante applied the novel technique of multi-fluor FISH (mFISH) to lymphocytes exposed to heavy ions at the Brookhaven National Laboratory. More recently he has worked with the University of Essen in Germany to apply mBAND techniques to analyze chromosomes after exposure to heavy ions.

After receiving his Physics degree in 1988 at the University Federico II in Naples, Italy, Dr. Durante entered the University of California in Berkeley, where he obtained a Ph.D. in Radiation Biophysics under the supervision of Dr. Tracy C. Yang. He joined Tracy Yang's group at NASA's Johnson Space Center in 1993 for a postdoctoral rotation and helped initiate a biodosimetry program for astronauts involved in the NASA/Mir missions. Later, Dr. Durante moved to the NIRS to study the induction of chromosomal aberrations in peripheral blood lymphocytes of cancer patients who were undergoing treatment with accelerated heavy ions.

Currently, Dr. Durante is Associate Professor of Physics at the University Federico II, one of the few academies in Europe providing a graduate program in radiation biophysics. Some of his former students work currently in radiation biophysics positions at Temple University, New Jersey Medical School, Columbia University (in the U.S.), and at the Gray Laboratory, University of Sheffield, and Chalmers University in Europe.

Dr. Durante has received numerous grants supported by the Italian Space Agency, Italian Institute for Nuclear Physics, Italian Ministry of Research, as well as a NASA grant to study the biological effects of heavy ions after traversal through different shielding materials. This NRA research investigation, approved in 2002, is a large scientific collaboration, involving four Italian research groups (Naples, Milan, Pavia, and Rome), NASA JSC, BNL, and NIRS (Japan). Each group measures different endpoints in human cells exposed to heavy ions (accelerated either at the NASA Space Radiation Laboratory or at the HIMAC) after traversal through shielding of different materials and thickness. Analyses of chromosomal aberrations, DNA double-strand breakage, mutations, and neoplastic transformations follow the exposures. The overall goal of the project is to provide a set of data to benchmark current models used to estimate spacecraft shielding.

Dr. Durante was the primary scientific organizer of the 1<sup>st</sup> International Workshop on Space Radiation Research held in Arona, Italy in 2000. He was also the main scientific organizer of sessions on space radiation effects during the COSPAR Scientific Assemblies in 2000, 2002, and 2004. He is a member of several radiation research societies, of the Editorial Board of *Journal of Radiation Research* (Tokyo), *Radiation and Environmental Biophysics* (Berlin), and *Radiation Biology & Radioecology* (Moscow), of the ESA Topical Team on Radiation Shielding, and of the Program Advisory Committee of GSI in Darmstadt, Germany

## Selected Publications

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