

SPACE LIFE SCIENCES SYMPOSIUM (A1)  
Radiation Fields, Effects and Risks in Human Space Missions (4)

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NASA SPACE RADIATION SUMMER SCHOOL FOR RESEARCH

**Abstract**

The major goal of NASA's space radiation research is to enable the human exploration of space within acceptable risks. Space radiation from galactic cosmic rays and solar particle events is distinct from common terrestrial forms of radiation because it is composed of very high-energy protons and heavy ions, as well as secondary radiations produced in shielding and tissue. Space radiation risks of concern include carcinogenesis, acute and late risks to the central nervous system, degenerative risks such as heart disease and cataracts, and acute radiation syndromes. As there are no human epidemiological data for these radiation types, risk estimation must be guided by mechanistic understanding based on radiation physics, and on molecular, cellular, tissue, and organismal radiation biology related to cancer, the central nervous system effects and other effects. NASA is working with Brookhaven National Laboratory to learn more about the possible risks to human beings exposed to space radiation. A US\$34-million NASA Space Radiation Laboratory (NSRL) has been established at Brookhaven to study the radiobiological effects using beams of accelerated ions that simulate the cosmic rays found in space, including HZE ions such as 1000 MeV/nucleon Fe ions. Research is performed by investigators throughout the US and abroad. The NASA Space Radiation Summer School (<http://www.dsls.usra.edu/spacerad>) is designed to provide a "pipeline" of multidisciplinary researchers to tackle the challenges. The Summer School is co-sponsored by NASA's Space Radiation Research Program, Brookhaven National Laboratory, and Universities Space Research Association. The three-week course, which has become increasingly competitive, is open to graduate students and postdoctoral fellows with an interest in radiation biology. Foreign nationals and U.S. citizens may apply and past participants have come from around the world. This concentrated program is taught by leading university and national laboratory biologists and physicists actively engaged in NASA space radiation research and BNL experts in heavy ion experimentation and methods. Each "professor" lectures on his/her research specialty with topics ranging from DNA damage/repair, to mutagenesis, epigenetics, signaling, systems biology, carcinogenesis and late degenerative effects following exposure to space radiation, as well as the space radiation environment, physics and biochemistry of charged particle interactions, track structure, dosimetry, accelerator operations and space radiation protection. The Summer School contributes to NASA's research program on the health risks of space radiation, to research in related areas of science (such as mechanisms of carcinogenesis and new developments in heavy particle radiotherapy) and to broadening research and educational collaboration worldwide.