NASA SBIR 2009 Phase I Solicitation

X14 Space Radiation

The goal of the NASA Space Radiation Research Program is to assure that we can safely live and work in the space radiation environment, anywhere, any time. Space radiation is different from forms of radiation encountered on Earth. Radiation in space consists of high-energy protons, heavy ions and secondary products created when the protons and heavy ions pass through spacecraft shielding and human tissue. The Space Radiation Program Element, within the Human Research Program uses the NASA Research Announcement as a primary means of soliciting research to understand the health risks and reduce the uncertainties in risk projection; however, there are areas where the SBIR program contributes. Specific areas where SBIR technologies can contribute to NASA's overall goal include: reliable radiation monitoring for manned and unmanned spaceflight; and radiation damage imaging.

http://hacd.jsc.nasa.gov/projects/space_radiation_overview.cfm

http://spaceradiation.usra.edu/

http://www.nsbri.org/Research/Radiation.html

Subtopics

X14.01 Active Charged Particle and Neutron Radiation Measurement Technologies

Lead Center: ARC

Participating Center(s): JSC

For exploration class missions, there is extraordinary premium on compact and reliable active detection systems to meet very stringent size and power requirements. NASA requires compact, low power, active monitors that can measure charged particle spectrum and flux separately from neutrons and other radiations. Also, NASA requires compact active neutron spectrometers that can measure the neutron component of the dose separate from the charged particles. Advanced technologies up to technology readiness level (TRL) 4 are requested in the following areas:

Charged Particle Spectrometer

Measure charge and energy spectra of protons and other ions (Z = 2 to 26) and be sensitive to charged particles with LET of 0.2 to 1000 keV/m. For Z less than 3, the spectrometer should detect energies in the range 30 MeV/n to 400 MeV/n. For Z = 3 to 26, the spectrometer should detect energies in the range 50 MeV/n to 1 GeV/n. Design goals for mass should be 2 kg and for volume, 3000 cc. The spectrometer should be able to measure charged particles at both ambient conditions in space (0.01 mGy/hr) and during a large solar particle event (100 mGy/hr). The time resolution should be less than or equal to 1 minute. The spectrometer shall be able to perform data reduction internally and provide processed data.

Neutron Spectrometer

Measure neutron energy spectra in the range of 0.5 MeV to 150 MeV. Measure neutrons at ambient conditions such that proton/ion veto capability should be approaching 100% at solar minimum GCR rates; measure ambient dose equivalent of 0.02 mSv in a 1 hour measurement period, using ICRP 74 (1997) conversion factors; store all necessary science data for post measurement data evaluation. Design goals for mass and volume should be 5 kg and 6000 cc, respectively.

X14.02 Miniature Radiation Pulse Processing Electronics

Lead Center: ARC

Participating Center(s): JSC

For Exploration class missions, there is extraordinary premium on compact and reliable active detection systems to meet very stringent size and power requirements. Miniaturized electronics for radiation pulse processing would be important to help reduce size/power needs. Very small technologies (chips) are developed by the computer industry that may be adaptable to process radiation induced pulses from detectors to provide multi-channel analysis (MCA) and other analysis functions with very low power and size requirements. This is a need for NASA as power and size requirements are severely tightened on future missions to the Moon and beyond. Advanced technologies up to technology readiness level (TRL) 4 are requested in this area.

The miniature processor must not exceed 0.2 W of power and have a volume not to exceed 20 cc. A communication interface, such as USB or other serial interface, is required. A fast clock rate is required, not less than 100 MHz. An analog-to-digital converter, minimum sample rate of 10 M samples per second. Could be part of chip or on the same board with chip. Requires adequate pulse height measurement to perform MCA, e.g., peak hold, digital waveform processing, or other approach. MCA should cover the input pulse height range of .002 to 10 volts (or equivalent) in either 100 channels on log scale or in two linear spectra of not less than 250 channels each with different gains.