Charged particles (protons and heavy ions) contribute most of the dose-equivalent received by astronauts. Current instruments at NASA, and those under development, can provide the total (combined) dose and dose-equivalent for protons, heavy ions, gamma rays, and neutrons. At present NASA has active detectors for ISS that measure energy fluence of charged particles; however, more compact detection systems that measures energy fluence and spectrum for Exploration class missions are needed. Advanced technologies (up to technology readiness level (TRL) level 4) are requested.

**Subtopic Requirements/Needs:**

Of particular interest are compact real-time detection systems that can measure energy fluence and spectrum of protons and other ions \( (Z = 2 \text{ to } 26) \) and be sensitive to charged particles with LET of 0.2 to 1000 keV/µm. For \( Z \) less than 3, the spectrometer should detect energies in the range 20 MeV/n to 400 MeV/n. For \( Z = 3 \text{ to } 26 \), the spectrometer should detect energies in the range 50 MeV/n to 1 GeV/n.

The monitor should be able to measure charged particles at both ambient conditions in space (0.005 mGy/hr) and during a large solar particle event (1000 mGy/hr).

The time resolution should be less than or equal to 1 minute.

The dosimeter shall be able to perform data reduction internally and provide processed data out to ISS, CEV, and future lunar outpost data systems. New software needs to be fault tolerant and updated to current operating systems, new hardware and software must be fully documented (schematics, etc.).