



NASA SBIR 2016 Phase I Solicitation

S1.05 Particles and Field Sensors and Instrument Enabling Technologies

Lead Center: GSFC

Participating Center(s): ARC, JPL, JSC, MSFC

Advanced sensors for the detection of elementary particles (atoms, molecules and their ions) and electric and magnetic fields in space and associated instrument technologies are often critical for enabling transformational science from the study of the sun's outer corona, to the solar wind, to the trapped radiation in Earth's and other planetary magnetic fields, and to the atmospheric composition of the planets and their moons. Improvements in particles and fields sensors and associated instrument technologies enable further scientific advancement for upcoming NASA missions such as CubeSats, Explorers, STP, and planetary exploration missions. Technology developments that result in a reduction in size, mass, power, and cost will enable these missions to proceed. Of interest are advanced magnetometers, electric field booms, ion/atom/molecule detectors, and associated support electronics and materials. Specific areas of interest include:

- High efficiency conversion surfaces for the conversion of Energetic Neutral Atoms (ENAs) to ions for increasing the sensitivity of low energy ENA instruments.
 - Science Traceability: Decadal survey missions: IMAP, MEDICI, DRIVE Initiative, EXPLORERs DISCOVERY, CubeSats / Smallsats, Sounding Rockets.
 - Need Horizon: 1 to 3 years, 3 to 5 years.
 - State of the Art: The efficiency of present SOA conversion surfaces is 1-2%. This is quite low and results to low sensitivities. An efficiency increase to 10% will lead to increased sensitivity by a factor of x 5 to 10 and /or smaller instruments sizes / resources.
 - Importance: Very High – Critical need for next generation low energy ENA instruments.
- Very low energy threshold < 5eV particle detectors for direct neutral particle detection.
 - Science Traceability: Explorer missions, Decadal survey missions IMAP, MEDICI, DYNAMICS, DRIVE Initiative, DISCOVERY and CubeSat/Smallsat missions.
 - Need Horizon: 1 to 3 years.
 - State of the Art: SOA solid state detectors have an energy threshold for particle detection of ~1keV. Although this problem can be overcome in charged particle detection with pre acceleration, it poses a severe limitation in direct neutral particle. New detectors with low energy threshold will enable a whole new class of instruments and improve existing instruments.
 - Importance: Very High – Critical need for next generation direct neutral instruments.
- UV filters that greatly attenuate UV Ly radiation but let particles freely pass through. Enabling technology for direct particle detection.
 - Science Traceability: Decadal survey missions: IMAP, MEDICI, DRIVE Initiative, EXPLORERs DISCOVERY, CubeSats / Smallsats, Sounding Rockets.
 - Need Horizon: 1 to 3 years, 3 to 5 years.
 - State of the Art: Particle detectors are very sensitive to UV light. The commonly used technology for direct particle detection is very thin foil the attenuate UV light but at the same time pose an energy threshold / scatter particles. A possible micro porous type of detector that greatly attenuates UV but

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- let particles pass through will greatly improve current instruments.
 - Importance: Very High – Critical need for next generation particle instruments.
 - Strong, compactly stowed magnetically clean magnetic field booms possibly using composite materials that deploy mag sensors (including internal harness) to distances up to 10 meters, for Cubesats;
 - Science Traceability: Explorer missions, DRIVE Initiative, CubeSat/Smallsat missions.
 - Need Horizon: 1 to 3 years.
 - State of the Art: Such a boom up to 10 meters long will high quality electric field measurements from small platforms.
 - Importance: Very High for future Cubesat and SmallSat stand alone and constellation missions.
 - Strong, lightweight, thin, rigid, compactly stowed electric field booms possibly using composite materials that deploy sensors (including internal harness) to distances of 10 m or more
 - Explorer missions, DRIVE Initiative, CubeSat/Smallsat missions.
 - Need Horizon: 1 to 3 years, 3 to 5 years.
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 - Importance: Very High for future Cubesat and SmallSat stand alone and constellation missions.