



NASA SBIR 2018 Phase I Solicitation

S1.06 Particles and Field Sensors and Instrument Enabling Technologies

Lead Center: GSFC

Participating Center(s): JPL, MSFC

Technology Area: TA8 Science Instruments, Observatories & Sensor Systems

While the size distribution of matter in space that ranges from large-scale (planets and moons and asteroids and dust) objects is quite well characterized down to micron-sized dust particles, below that there is a significant, largely unobserved gap down to single ions/electrons/ENAs. To cover the observational gap between 10^{-6} m and 10^{-10} m in particle size that includes nano-dust and molecules in space, new technology investment is needed. 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, LWS, 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, dust particle detectors, and associated support electronics and materials. Specific areas of interest include:

- High Voltage Optocoupler / Optoisolator or isolation transformers:
 - Science Traceability: Explorer missions, Decadal survey missions IMAP, MEDICI, GDC, DYNAMICS, DRIVE Initiative, DISCOVERY, New Frontiers, and CubeSat, SmallSat missions, Sub-orbitals.
 - Need Horizon: 1 to 3 years, 3 to 5 years.
 - Low energy particle instruments often require significant high voltage in the range 5KV to 20KV. Floating the electronics is an attractive for low noise. A high reliability radiation hardened device for transferring power, signal and commands across a high voltage is a very useful component. Typical specifications 3.3V and 5V up to 1A, speed up to 1MHz, -55° C to $+85^{\circ}$ C, and 300 krad.
 - Importance: High and Critical need for next generation particle instruments.
- Curved microchannel plates (MCPs):
 - Science Traceability: Explorer missions, Decadal survey missions IMAP, MEDICI, GDC, DYNAMICS, DRIVE Initiative, DISCOVERY, New Frontiers, and CubeSat, SmallSat missions, Sub-orbitals.
 - Need Horizon: 1 to 3 years.
 - It is highly desirable for MCP channel angles to match MCP curvature. This will make MCP gain and imaging quality independent of incident particle angle. This property will be very useful for particle

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- imaging instruments using MCPs.
 - Importance: Very High for future flagship and Cubesat and SmallSat missions.
 - Micro machined particle collimators:
 - Explorer missions, Decadal survey missions IMAP, MEDICI, GDC, DYNAMICS, DRIVE Initiative, DISCOVERY, New Frontiers, and CubeSat, SmallSat missions, Sub-orbitals.
 - Need Horizon: 1 to 3 years, 3 to 5 years.
 - State of art: Light weight vibration reliable, particle collimators from thin metal or other material with FOV to be made in the range of 2dex2 deg to 20x20 deg with physics transparency ≥ 70 .
 - Importance: High: Critical need for next generation particle instruments.