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The Next Generation of Space Plasma Analyzer - Deployable Radial Imaging for Velocity, Energy, and Density (DRIVEN)

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We present initial developments towards a space plasma analyzer capable of making simultaneous observations of cold (<1eV) and high-energy (5keV) space plasmas at revolutionary temporal and spatial resolution. "Top Hat" plasma analyzers [1] (the current "state of the art") typically have modest azimuthal resolution (c.f. 10 degrees, for reasons of electronic practicality), and can only read out a single energy at a time, thereby requiring a swept voltage to sample a range of energies. True energy imaging of particle populations was achieved with the Freja Cold Plasma Analyzer [2], and at higher time and energy resolution on subsequent sounding rocket flights using a CCD-based detection scheme, but only at energies below 200 eV [3]. We propose to overcome these shortcomings using novel particle optics and directly imaging space plasma distributions using a revolutionary 2D position-sensitive readout technique, thereby covering particle energies from cold to energetic while eliminating the need for an energy sweep. Measurements of <1eV electrons and ions are currently very challenging owing to effects of spacecraft charging. Existing s/c systems such as ASPOC on Cluster are complex, expensive and have a limited lifetime. Our boom-mounted sensor will automatically compensate for changes in spacecraft potential through the reverse biasing of its outer skin according to measurements from an integrated Langmuir probe.

[1] Carlson et al., Adv. Space Res., 2(7), 67, (1982)
[2] Whalen et al., Space Sci. Rev., (70), 541. (1994)
[3] Knudsen et al., Rev. Sci. Instrum., (74), 202. (2003)