POSTER ABSTRACTS

Guo, Fan	***Formation of a Power-law Distribution during Magnetic Reconnection: Particle-in-cell Simulations and Analytical Theory*** Fan Guo, Los Alamos National Laboratory Hui Li, Los Alamos National Laboratory William Daughton, Los Alamos National Laboratory Yi-Hsin Liu, Los Alamos National Laboratory We present results from full particle-in-cell simulations (without loss term) that show the formation of a power-law distribution during magnetic reconnection when the magnetic energy dominates over other forms of energy. We have developed an analytical theory to describe the power-law spectrum. The work shows that astrophysical reconnection sites can be important sources of high-energy cosmic rays.
Janzen, Paul	***The IBEX Ribbon at the Lowest IBEX-Hi Energy Range*** Paul H Janzen, University of Montana Herbert O Funsten, Los Alamos National Laboratory David J McComas, Southwest Research Institute Daniel B Reisenfeld, University of Montana Nathan A Schwadron, University of New Hampshire The lowest-energy setting of the IBEX-Hi sensor (around 450 eV) is prone to significant backgrounds. Data at this setting have been excluded from general heliospheric analysis, and the setting stopped being used about four years into the mission. However, since the backgrounds do not vary rapidly with spin angle, sharp features can still be observed. The lowest-energy IBEX-Hi data are analyzed to extract the signature of the IBEX Ribbon above the more general heliospheric signal and backgrounds, in order to constrain the lower-energy bound of the Ribbon.
Macek, Wieslaw M.	***Magnetic reconnection at the heliopause: magnetic connections and transport of plasma between the inner and outer heliosheath*** M. Strumik, Space Research Centre, Polish Academy of Sciences, Poland. A. Czechowski, Space Research Centre, Polish Academy of Sciences, Poland. S. Grzedzielski, Space Research Centre, Polish Academy of Sciences, Poland. W. M. Macek, Space Research Centre, Polish Academy of Sciences, Poland; Faculty of Mathematics and Natural Sciences, Cardinal Stefan Wyszynski University, Poland R. Ratkiewicz, Space Research Centre, Polish Academy of Sciences, Poland; Institute of Aviation, Poland. We discuss processes related to magnetic reconnection and plasma turbulence occurring in the vicinity of the heliopause (HP) and the heliospheric current sheet. We show that the interaction of magnetic islands initiated by the reconnection may provide magnetic connections and lead to an enhanced transport of energetic particles between the interstellar medium and solar wind plasma. We propose an interpretation of the Voyager 1 observations in 2012 in terms of fine-scale physical processes occurring at reconnecting HP. Our simulations also reveal a mechanism of advective transport of relatively dense interstellar plasma to the heliosphere associated with annihilation of magnetic sectors in the heliospheric neighbourhood of the HP.
Roelof, Edmond	***The Group Abundance Fraction: A Statistically Robust Measure of Particle Composition and Spatial Structure*** Johns Hopkins University/Applied Physics Laboratory Laurel, MD, USA Voyager 1 now appears to be measuring the composition of galactic cosmic rays down to energies of a few MeV/nucleon, albeit at rather low counting rates, there is a need for a statistically robust measure of composition "ratios" between two species e.g., A/B at a specified energy/nucleon. Inconveniently, the ratio itself, although intuitively attractive, is not a well-defined statistical parameter when the number of individual counts of either component is low. It is unclear how to specify the statistical uncertainty of the ratio, since there is a finite probability that there may be no counts of one component (A or B) within a finite accumulation time, even if the total of the accumulated counts (A and B) is non-zero. However, the "Group Abundance Fraction" (F) of either component, e.g., A/(A+B), is a statistically robust parameter, so we can rigorously and exactly derive expectation values (over a Poisson statistical ensemble) for <F> and its standard deviation sigF that are valid for all values of total counts greater than one. We also derive useful estimators for these ensemble expectation values in terms of the actual observed accumulated counts. Since the derivations utilize only the most general properties of the Poisson distribution, the results are not restricted to time series, but are also applicable to spatial distributions in which A and B represent counts in adjacent "pixels" of a spatial map. Thus the same results may be useful for the statistical analysis of "edges" of localized spatial structure in all-sky maps from IBEX or from Cassini/INCA of intensities of energetic neutral H-atoms from the regions beyond the heliospheric termination shock.

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Zank, Gary	***Instability of the Heliopause Driven by Charge Exchange Interactions*** G.P. Zank, University of Alabama in Huntsville, USA K. Avinash, University of Alabama in Huntsville, USA and University of Delhi, India B. Dasgupta, University of Alabama in Huntsville, USA Shikha Bhadoria, University of Delhi, India The stability of the heliopause that separates the tenuous hot heliosheath plasma from the relatively dense cool magnetized plasma of the local interstellar medium (LISM), is examined. The charge exchange coupling between the plasma ions and the primary interstellar neutral atoms provides an "effective gravity", introducing the possibility of Rayleigh Taylor (RT) instabilities while a shear flow due to the velocity difference between the heliosheath and the interstellar flows can drive Kelvin Helmholtz (KH) modes in the neighborhood of heliopause. The model includes a number of effects which are important in the heliosphere e.g, resonant change exchange between the primary neutrals and the solar wind plasma, effects of energetic neutral hydrogen atoms (ENA) from the inner heliosheath, plasma flows along the heliopause and magnetic fields in the inner and outer heliosheath. Our analysis shows that, in the relevant parameter space of the heliopause, the nose region is indeed unstable to RT modes while the shoulder region is unstable to a mixed RT-KH mode. The stabilization due to typical values of magnetic field that are present is not sufficient. ENAs are found to have an interesting role in the stability of heliopause. Whereas they have a stabilizing influence on the RT instability (due to counter streaming), they have a destabilizing influence on the KH instability Thus in the flanks, where the RT drive due to primary neutrals in eliminated, the KH modes are completely stabilized by magnetic fields in absence of ENAs. In the presence of ENAs (despite the magnetic field) the KH instability in the flanks is fully resuscitated. Thus, in the presence of magnetic field, ENAs are essential for KH instability on the flanks. These results are consistent with the simulations of Borovikov et al (2008). The nonlinear phase of these instabilities is discussed briefly. We conclude by speculating briefly on the effect that the instability might have on the magnetic field structure in the vicinity of the HP, the possibility that reconnection may be responsible for connecting heliospheric and interstellar magnetic field, and possible observational implications for Voyager 1 and 2 observations.
Zank, Gary	***Particle Acceleration via Reconnection Processes in the Supersonic Solar Wind*** G.P. Zank, Center for Space Plasma and Aeronomic Research -and- Department of Space Science, University of Alabama in Huntsville, USA J.A. le Roux, Center for Space Plasma and Aeronomic Research -and- Department of Space Science, University of Alabama in Huntsville, USA G.M. Webb, Center for Space Plasma and Aeronomic Research, University of Alabama in Huntsville, USA A. Dosch, Center for Space Plasma and Aeronomic Research, University of Alabama in Huntsville, USA An emerging paradigm for the dissipation of magnetic turbulence in the supersonic solar wind is via localized small-scale reconnection processes, essentially between quasi-2D interacting magnetic islands. The induced or anti-reconnection electric field generated by magnetic island merging can accelerate charged particles trapped in the vicinity of the merging region. We derive a gyrophase-averaged transport equation for particles experiencing pitch-angle scattering and energization in a super-Alfvenic flowing plasma experiencing multiple small-scale reconnection events. A simpler advection-diffusion transport equation for a nearly isotropic particle distribution is derived. Solving the steady-state isotropic transport equation with a fixed source yields a power law spectrum for the accelerated particles with index $\alpha = -(3 + MA)/2$, where MA is the Alfven Mach number. Throughout the supersonic solar wind, MA ~ 7 implying that $\alpha \sim -5$. We suggest that the widely reported c^(−5) (c particle speed) spectra observed in the quiet supersonic solar wind (Fisk & Gloeckler (2006, 2012); Mewaldt et al. (2001)) are a natural consequence of particle acceleration associated with dissipative small-scale reconnection processes in a turbulent plasma.