18th ANNUAL INTERNATIONAL ASTROPHYSICS CONFERENCE
POSTER ABSTRACTS

Che, Haihong	***The Solar Wind Electron Halo as Produced by Electron Beams Originating in Nanoflares: Beam Density Dependence*** Haihong Che, UMCP/GSFC, USA M. L. Goldstein, SSI, USA C. S. Salem, SSL, UC Berkeley, USA A. F. Vinas, GSFC, USA It has been suggested recently \citep{che14apjl} that the nearly isotropic electron halo seen in the electron velocity distribution function of the solar wind may originate from nanoflares, where accelerated electron beams are unstable to electron two-stream instability (ETSI) and the beams are heated and generate whistler and kinetic Alfv\'en waves. The kinetic waves then scatter the hot electron tail into an isotropic halo. This model can explain various observations of the solar wind. However, since the density and the drift of the electron beams in the source region in the corona cannot be directly measured, understanding how beam density and drift affect the electron velocity function is essential to establish the link between the solar wind observables and the electron dynamics in nanoflares. In this paper Using particle-in-cell simulations and kinetic theory, we show that a necessary condition for an isotropic halo to develop is that the beam density be lower than a critical density $N_c \sim 0.3$. Heating of the core electrons becomes weaker with decreasing beam density, while the heating of halo electrons becomes stronger. As a result, the temperature ratio of the halo and core electrons increases with the decrease of the beam density. We also apply these results to the current observations and discuss the possible optimal electron beam density produced in the nanoflares.
Guo, Fan	***The Acceleration of Energetic Particles at Coronal Shocks and Emergence of a Double Power Law Feature in Particle Energy Spectra*** Xiangliang Kong, Shandong University at Weihai, China Fan Guo, Los Alamos National Laboratory, USA Yao Chen, Shandong University at Weihai, China Joe Giacalone, University of Arizona, USA We present numerical modelling of particle acceleration at coronal shocks propagating through a streamer-like magnetic field by solving the Parker transport equation with spatial diffusion both along and across the magnetic field.. We show that the location on the shock where the high-energy particle intensity is the largest, depends on the energy of the particles and on time. The acceleration of particles to more than 100 MeV mainly occurs in the shock-streamer interaction region, due to perpendicular shock geometry and the trapping effect of closed magnetic fields. A comparison of the particle spectra to that in a radial magnetic field shows that the particle intensity at 100 MeV (200 MeV) is enhanced by more than one order (two orders) of magnitude. This indicates that the streamer-like magnetic field can be an important factor in producing large SEP events. We also show that the energy spectrum integrated over the simulation domain consists of two different power laws. Further analysis suggests that it may be a mixture of two distinct populations accelerated in the streamer and open field regions, where the acceleration rate differs substantially. Our calculations also show that the particle spectra are affected considerably by a number of parameters, such as the streamer tilt angle, particle spatial diffusion coefficient, and shock compression ratio. While the low-energy spectra agree well with standard diffusive shock acceleration theory, the break energy ranges from a few MeV to ~90 MeV and the high-energy spectra can extends to ~1 GeV with a slope of ~2-3.
Guo, Fan	***Determining the Dominant Acceleration Mechanism during Relativistic Magnetic Reconnection in Large-scale Systems*** Fan Guo, Los Alamos National Laboratory, USA While a growing body of research indicates that relativistic magnetic reconnection is a prodigious source of particle acceleration in high-energy astrophysical systems, the dominant acceleration mechanism remains controversial. Using a combination of fully kinetic simulations and theoretical analysis, we demonstrate that Fermi-type acceleration within the large-scale motional electric fields dominates over direct acceleration from non-ideal electric fields within small-scale diffusion regions. This result has profound implications for modeling particle acceleration in large-scale astrophysical problems, since it opens up the possiblity of modeling the energetic spectra without resolving microscopic diffusion regions.

Roelof, Edmond	***The Plasma Heliopause was like a Sphere: Evidence from Voyager 2-3 kHz radio emission (1992-1994)*** Edmond C. Roelof, JHU/APL, USA Knowledge of the shape of the plasma heliopause (HP) boundary between the heliosheath plasma (Ne~0.001/cc) and the adjacent interstellar plasma (Ne~0.1/cc) will be essential for the design of the Interstellar Probe mission. For decades, the choices have seemed to lie between shapes whose draped local interstellar magnetic field is comet-like (with a long "tail" in the direction downwind from the interstellar plasma flow), or more bubble-like. New evidence favoring the plasma "bubble" comes from the 2-3 kHz radio emission detected by the Voyager 1/2 PWS experiment during the intense long-lasting events 1992-1994, commencing with a cluster of "fast-drift" bursts from 1.8-3.6 kHz that lasted about 70d, combined with >180d "cavity" emission between 1.8-2.3 kHz that exhibited a very slow upward frequency drift. Intensities of the fast-drift bursts 2.5-3.6 kHz maximized in the "upwind" hemisphere, but the cavity radiation was essentially isotropic. D. A. Gurnett, W. S. Kurth, and their collaborators have identified the 1.8-2.3 kHz radio emission with electron-beam-generated electron plasma oscillations in the plasma density gradient at the HP and the 2.5-3.6 kHz with density gradients beyond the HP in the upstream interstellar medium. Since light velocity is 172 AU/d, the photons in the 1.8-2.3 kHz cavity radiation must have travelled >200 times the radius of the HP during their confinement within a very high-Q cavity (whose topology must therefore be nearly "closed" and topologically equivalent to a sphere). The 70 d spread in the onsets of the cluster of anisotropic fast-drift bursts confines the HP shape to be quasi-spherical to within a few tens of per cent. The so-far-unexplained very slow drift of the isotropic 1.8-2.3 kHz emission can be produced by an inward radial motion of the HP at about 16 km/s. Although these inferences hold strictly only for the large 1992-1994 events, they may also be consistent with the Voyager 1/2 in situ observations during 2010-2018.