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Interplanetary Energetic Electrons

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Acceleration and transport of energetic particles is one of the fundamental research areas in space physics, astrophysics and plasma physics. The Sun and heliosphere serve as a huge natural laboratory for exploring the origin and physical nature of energetic particles in space. Interplanetary energetic electrons mainly consist of solar wind superhalo electrons and solar energetic electron (SEE) events (Figure 1).[1] In the solar wind, superhalo electrons are continuously present at energies above ~2 keV, even unaccompanied by significant interplanetary and/or solar activities.[2] At quiet times, superhalo electrons typically exhibit a roughly isotropic pitch angle distribution and a single-power-law energy spectrum with an average power-law index of ~2.4 at energies of ~2-200 keV.[2, 4, 7] SEE events[3], typically observed at energies of ~1-100s keV, are thought to be caused by the particle acceleration processes associated with solar eruptions, e.g., solar flares and/or coronal mass ejections. SEEs often beam antisunwards along the interplanetary magnetic field and show a double-power-law energy spectrum that steepens at high energies.

In this talk, we will review recent results of solar wind superhalo electrons and SEE events measured by the Wind and/or STEREO spacecraft in the interplanetary medium near 1 AU. Then we present the observational evidences that these interplanetary electrons enter the terrestrial polar cusp, cap and/or lobes, by combining the electron measurements from the Wind and Beidou spacecraft.[1, 5, 6]

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References

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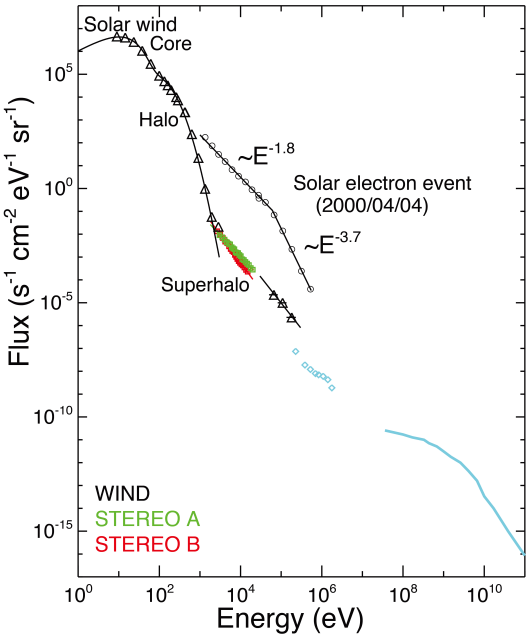

Figure 1. Interplanetary electron flux versus energy spectrum from ~10 eV to 1 TeV at 1 AU. The black triangles, colored squares and blue diamond denote the solar wind electron populations observed at quiet times by Wind, STEREO and IMP-7, and the blue curve shows the galactic cosmic-ray electrons detected by IMP-6. The black circles represent a SEE event observed by Wind on April 04, 2000.