The Energy Spectrum of Solar Energetic Electron Events

Linghua Wang\textsuperscript{1}, Zixuan Liu\textsuperscript{1}, Haobo Fu\textsuperscript{1}, and Sam Krucker\textsuperscript{2}

\textsuperscript{1}Peking University, Institute of Space Physics and Applied Technology, School of Earth and Space Sciences, Beijing, China (wanglhwang@gmail.com)

\textsuperscript{2}Space Sciences Lab, University of California, Berkeley, USA

Solar energetic electron events (SEEs) are one of the most common particle acceleration phenomena occurring at the Sun, and their energy spectrum likely reflects the crucial information on the acceleration. Here we present a statistical survey of the energy spectrum of 160 SEEs measured by Wind/3DP with a clear velocity dispersion at energies of \~1-200 keV from January 1995 through December 2016, utilizing a general spectrum formula proposed by Liu et al. (2000). We find that among these 160 SEEs, 144 (90\%) have a power-law (or power-law-like) spectrum bending down at high energies, including 108 (67.5\%) double-power-law events, 24 (15\%) Ellison-Ramaty-like events and 12 (7.5\%) log-parabola events, while 16 (10\%) have a power-law spectrum extending to high energies. The average power-law spectral index $\beta_1$ is 2.1±0.4 for double-power-law events, 1.7±0.8 for Ellison-Ramaty-like events, and 2.8±0.11 for single-power-law events. For the 108 double-power-law events, the spectral break energy $E_0$ ranges from 2 keV to 165 keV, with an average of 71±79 keV, while the average spectral index $\beta_2$ at energies above $E_0$ is 4.4±2.3. $E_0$ shows a positive correlation with the electron peak flux at energies above \~40 keV, while $\beta_1$ has a negative correlation with the electron peak flux at energies above \~15 keV.