Session 23 Summary:
What are the Physical Drivers of Energetic Storm Particle (ESP) events?

Scene Setting Speakers: Lulu Zhao (FIT), Joe Giacalone (UofA)
Organizers: Maher Dayeh (SwRI/UTSA), Rob Ebert (SwRI/UTSA) and Gang Li (UAH)
Time: Tuesday PM (14:00 – 17:00)
Place: Room 3131
What is an ESP Event?

Adapted from Cane, Reames, and von Rosenvinge, 1988
Q1. IP shock vs. ESP properties

Reames et al. 2012
Q1. IP shock vs. ESP properties

\[ f_2 \propto p^{-\alpha} \]

van Ness et al., 1984

\[
\frac{\partial f}{\partial t} = -V_{w,i} \frac{\partial f}{\partial x_i} + \frac{\partial}{\partial x_i} \kappa_{ij} \frac{\partial f}{\partial x_j} - V_{D,i} \frac{\partial f}{\partial x_i} + \frac{1}{3} \frac{\partial V_{w,i}}{\partial x_i} \frac{\partial f}{\partial \ln p} + Q
\]

advection diffusion drift energy change

Giacalone, 2012
Q2. SW vs. suprathermal ions as source for ESPs

Evidence for suprathermal ions as source for energetic particles

Evidence for solar wind ions as source for energetic particles

Symbols: ACE/SWICS observations before and after a strong IP shock (94/2001)

Desai et al. 2004

Courtesy of J. Giacalone (follow-up to Lario et al. 2018)
Q3. ESP variability

Fig. 15

Preisser et al. SHINE 2019
Session Topics

Questions

Q1. What is the relationship between locally observed IP shock properties, upstream solar wind conditions, and ESP properties such as intensities, energy spectra, and abundances?

Q2. How do upstream conditions (e.g. turbulence, presence of seed populations) affect ESP production and properties?

Q3. What causes the event-to-event and intra-event variability in ESPs observed at two or more longitudinally separated spacecraft?