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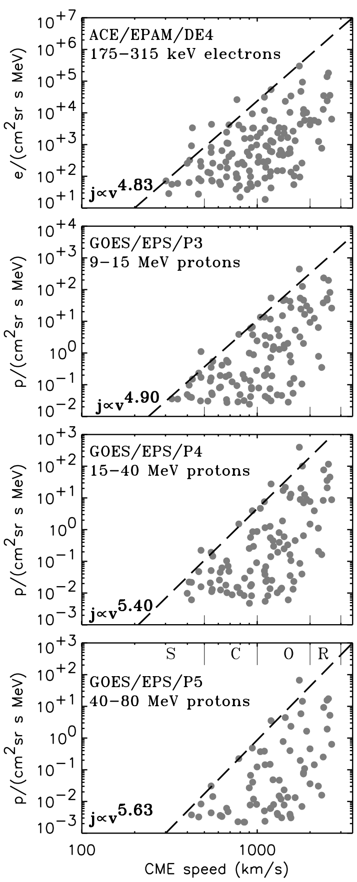
Triangular Distributions of SEP Peak Intensities *vs.* CME speeds: Implications for Real-Time Space Weather Applications.

There is a remarkable pattern (with strong implications for Space Weather) in the peak intensities measured in the prompt component of western solar energetic particle (SEP) events observed throughout solar cycle 23 near Earth. Cane *et al.* [JGR 115, A08101, 2010] listed events with ~20-30 MeV proton peak intensities above 2×10^{-4} particles $(cm^2\ sr\ s\ MeV)^{-1}$. We then restricted this list to magnetically well-connected SEP events associated with flares W10°-W100° in which the prompt intensity peak was identifiable in 175-315 keV ACE/EPAM electrons, as well as in any of the 9-15, 15-40 or 40-80 MeV GOES/EPS proton channels. The peak intensity of the event during their prompt component is taken as the maximum intensity observed shortly after the onset of the event and several hours or days before the particle enhancement commonly associated with the arrival of interplanetary shocks. Details are given by Lario and Karelitz [JGR 119, 4185, 2014]. In the Figure below, the SEP prompt peak intensities are plotted against the SOHO/LASCO plane-of-sky speed of the coronal mass ejection (CME; see http://cdaw.gsfc.nasa.gov/CME_list/) associated with the SEP event.



The triangular distributions stand out, and the diagonal dashed straight lines in each panel of the Figure provide (with a few minor exceptions) an upper limit to the prompt SEP peak intensity (j) for a given CME velocity (v). The lines are expressed as a power law $j \propto v^n$. Solely from this limit of triangle distributions, we could *predict* with considerable confidence the *maximum* SEP prompt peak intensity for any given plane-of-sky CME velocity (v). If inner coronagraph images were available *in real time* with a cadence <10 minutes, then a *real-time* estimate of (v) could be made within 20 minutes, whereas ~20 MeV protons take ~ 1 hour before *first arrival* at Earth (the *prompt peak* is still later). Allowing for the 8 1/3 minute transit time of the CME images, this would still provide *at least* 1/2 hour Space Weather warning for the arrival of the maximum prompt peak intensity in the largest magnetically well-connected SEP events.

This item was submitted by David Lario and Edmond Roelof, *Johns Hopkins University/Applied Physics Laboratory,* Laurel MD 20723-6099, on behalf of the ACE/EPAM Team. Address questions or comments to David.Lario@jhuapl.edu. For an archive of earlier ACE News items please see *http://www.srl.caltech.edu/ACE/ACENews_Archives.html* .