A Valley in Heliospheric Energetic Particle Intensities // Implication for the upcoming New Horizons' Termination shock crossing

This study utilizes the synergy between the Voyager (V1 and V2)/LECP and New Horizons (NH)/PEPSS energetic particles observations to gain a better understanding of processes from the inner to the outer heliosphere.

The analysis of the radial dependence of 50 – 200 keV energetic particles intensities normalized based on 1-au observations to account for solar cycle effects (Figure 1*)* shows the following:

- A decrease with increasing distance, followed by a minimum and a subsequent rise (not shown) before the termination shock crossing (TS), thereby producing what we call the heliospheric *valley*.
- An approximate piece-wise "broken" power-law relationship to helioradius, with a steeper decline beyond the ~30 au break.
- This break may demarcated differences in the dominant transport and acceleration mechanisms operating in the two regions .

The close agreement in the radial behavior of energetic particle observations from Voyager and New Horizons, despite sampling different regions at different times, suggests the presence of universal processes dominant in different regions of the outer heliosphere and offers valuable insight into NH's proximity to the TS.

The characteristics of the heliospheric valley are used to estimate the distance to the TS for operational purposes, corresponding to NH crossing the TS between 2027 (68 au) and 2034 (83 au).

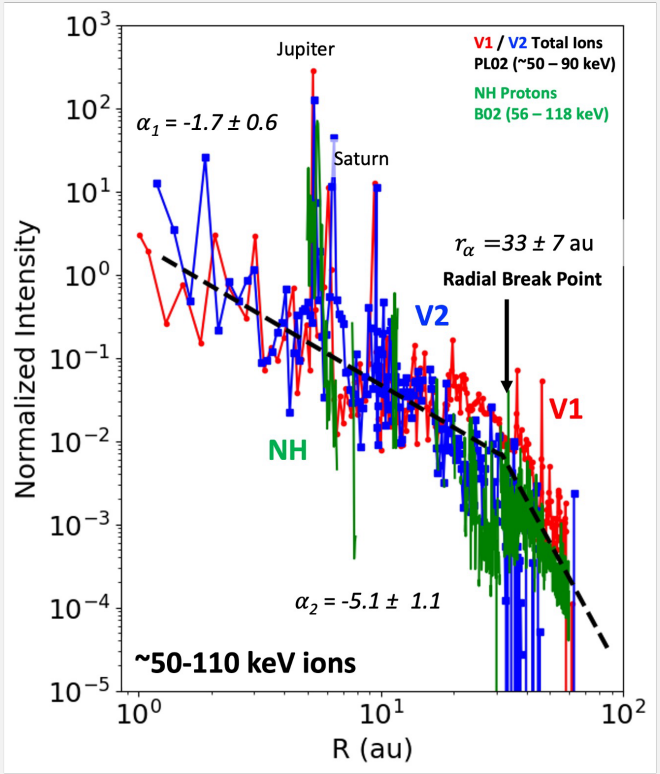

Figure 1. Radial dependance of normalized V1, V2, and NH energetic particle intensities.

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