



## **Multi-spacecraft Investigation of Multiple Particle Injections Induced by isolated Interplanetary Shock**

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The sudden enhancements in solar wind dynamic pressure associated with Interplanetary (IP) shocks cause magnetospheric compressions and often result in the injection of charged particles deep into the inner magnetosphere. These injections sometimes result in multiple periodic particle drift echoes, particularly at higher energies. The longitudinal drift period of particles in the magnetosphere depends on particle charge state, energy, equatorial pitch-angle, and L-shell. The present study investigates the multiple particle drift echoes associated with the impact of an IP shock observed by both the Van Allen Probes and ERG spacecraft simultaneously on July 16, 2017. The IP shock parameters were measured by the Advanced Composition Explorer and Wind spacecraft in the solar wind. The Relativistic Electron Proton Telescope (REPT) and Magnetic Electron Ion Spectrometer (MagEIS) onboard the Van Allen Probes were used to identify and study these shock-induced drift echoes. The origin and spatial extent of the particle injection location were determined based on the time of flight method. The concurrent occurrence of multiple injections ~2 mins after the shock onset is observed. The broadening of the drift-echo observed by the Van Allen Probes-B implies an injection location closer to Van Allen Probe A. The presence of ULF wave activity was observed after the shock impact in Van Allen Probes electric field measurements. Wave data from the Van Allen probes were also analyzed to understand the nature of wave-particle interactions. The underlying mechanisms for the temporal and spatial evolution of drift echoes are discussed in the frame of the present understanding.