



## **Observations of the CME shocks and the production of SEPs**

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The acceleration mechanism of SEPs is still a hot debated problem especially during the onset of large SEPs. Here, we present a case study on 2011-08-09 SEP event to clarify its acceleration source and an 3D statistical study including 22 SEPs in order to know where and how the particles are released. Based on the remote-sensing and in-situ observations as well as the DSA theory, we found that the theoretical particle spectrum was comparable to a observational one and a weak correlation was obtained between the electrons producing HXR and the in-situ observed electrons. These results indicated that the coronal shock wave was the potential accelerator of SEPs. In statistical study, we obtained the electrons and protons solar release and compared to the 3D CME structures and HXR observation from RHESSI. It is found the electrons are released  $\sim 15$  minutes earlier than the protons and both electrons and protons release are in decay phase of flare eruptions. The simulations of SEP propagation tell us that the time difference of the electrons and protons release probably arises from their scattering propagation in interplanetary space.