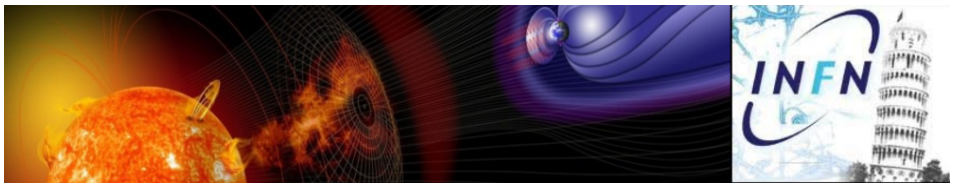

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Solar Energetic Electron Events Associated with Hard X-Ray Flares

Thursday, 8 July 2021 17:40 (4 minutes)

We investigate 16 solar energetic electron (SEE) events measured by WIND/3DP with a double-power-law spectrum and the associated western hard X-ray (HXR) flares measured by RHESSI with good count statistics, from 2002 February to 2016 December. In all the 16 cases, the presence of an SEE power-law spectrum extending down to ~5 keV at 1 au implies that the SEE source would be high in the corona, at a heliocentric distance of >1.3 solar radii, while the footpoint or footpoint-like emissions shown in HXR images suggest that the observed HXRs are likely produced mainly by HXR-producing electrons via thick-target bremsstrahlung processes very low in the corona. We find that for all the 16 cases, the estimated power-law spectral index of HXR-producing electrons is no less than the observed high-energy spectral index of SEEs, and it shows a positive correlation with the high-energy spectral index of SEEs. In addition, the estimated number of SEEs is only ~10−4–10−2 of the estimated number of HXR-producing electrons at energies above 30 keV, but with a positive correlation between the two numbers. These results suggest that in these cases, SEEs are likely formed by upward-traveling electrons from an acceleration source high in the corona, while their downward-traveling counterparts may undergo a secondary acceleration before producing HXRs via thick-target bremsstrahlung processes. In addition, the associated 3He/4He ratio is positively correlated with the observed high-energy spectral index of SEEs, indicating a possible relation of the 3He ion acceleration with high-energy SEEs.

Email

wenwang@pku.edu.cn

Primary authors: WANG, wen; Prof. WANG, Linghua (Peking University); Prof. KRUCKER, Sam; Prof. MASON, Glenn; Prof. YANG, Su; Prof. BUCIK, Radoslav

Presenter: WANG, wen

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