TIME-PROFILE STUDY OF TYPE III SOLAR RADIO BURSTS USING PARKER SOLAR PROBE

Tulsi Thapa[1] and Yihua Yan[1,2,3]

[1]*State Key Laboratory of Space Weather, National Space Science Center, CAS, Beijing, China,* tulsithapa@nssc.ac.cn

[2]*School of Astronomy and Space Sciences, University of Chinese Academy of Sciences, CAS, China*

[3]*National Astronomical Observatories, Chinese Academy of Sciences (NAOC), Beijing, China*

Solar type III radio bursts are crucial indicators of energetic electron activity in the solar corona and interplanetary space. Our assessment of 43 interplanetary type III bursts, recorded by the FIELDS Instrument onboard the Parker Solar Probe during Encounters 05 to 11, has led to significant and complex findings. We have analyzed the time-profile features of these bursts across a frequency range from approximately 19 MHz down to 0.5 MHz, revealing dependencies on frequencies and derived insights into burst duration, speeds, bandwidths, and drift rates. This novel analysis revealed spectral indices of -0.63±0.04 for rise time, -0.69±0.03 for decay time, and -0.68±0.02 for total duration, exhibiting a nature of an inverse square root of the frequency with the time profile. We have determined the average electron beam velocities for the exciter's front, middle, and back as 0.15c, 0.13c, and 0.08c, respectively, corresponding to electron energies ranging from tens of eV to hundreds of keV. Our findings show that faster electron beams were found to generate emissions with shorter durations. We determine that the time-profile asymmetry is independent of the frequency, suggesting a crucial characteristic that could impact electron beam generation. Furthermore, we identified a strong dependency of burst duration on rise, peak, and decay times, particularly significant with decay time (CC=0.95). This indicates that the entire temporal profile, including rise, peak and decay phases collectively contributes to event duration and is not solely influenced by external factors like plasma conditions or electron beam dynamics but also by internal burst processes. These findings provide valuable insights into the temporal and spectral characteristics of type III solar radio bursts, shedding light on the underlying physical mechanisms governing burst dynamics.