

Investigating Closed Coronal Structures Through J- and U-Type Solar Radio Bursts

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Solar radio bursts (SRBs) are transient radio emissions generated by energetic electrons interacting with coronal and interplanetary plasma, serving as key diagnostics of electron acceleration. They help us understand how magnetic fields are shaped in the solar atmosphere. Among the different types of SRBs, J-type and U-type bursts are particularly useful for investigating electron motion in the low solar corona.

We studied SRB events from Solar Cycle 25 and present a case study of two events, one J-type and one U-type SRB, seen using the wide e-CALLISTO network. For each event, we traced the burst on the dynamic spectrum and used the Newkirk coronal density model to calculate the height in the corona over time, the frequency drift rate, and the speed of the electron beam. Additionally, Potential-Field Source-Surface extrapolations were used to check the magnetic connection for both events, and the loop shapes matched well with the density model results. The J-type burst showed a fast frequency drift that stopped suddenly, suggesting the electrons moved along a short, uneven closed loop. The U-type burst showed a more even frequency change on both sides. We also checked whether these events were linked to any solar flares to understand their possible origin.

Building on this case study, we extended our work to a full analysis of J- and U-type SRBs (18 J-type and 20 U-type) observed during the ascending phase of Solar Cycle 25, from June 2020 to December 2024, using the Newkirk and PFSS models, and we draw conclusions on the nature of J- and U-type SRBs based on their frequency drift rate.