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Investigating the Coronal Sources of Solar Type III Radio Bursts on a Spotless Day: Insights from September 18, 2021

Understanding the mechanisms of high-energy particle production and propagation from the Sun is crucial for advancing solar physics and enhancing space weather prediction. This work aims to elucidate electron acceleration processes within the solar atmosphere and their journey into the heliosphere. We use data from advanced radio telescopes, such as the Low-Frequency Array and Nançay RadioHeliograph, along with X-ray and extreme ultraviolet observations, to identify energy release and electron acceleration regions in the solar corona. We simulate the trajectories of these electrons along magnetic field lines as they escape into the heliosphere.

Direct measurements of these electrons will be obtained through Parker Solar Probe and Solar Orbiter, positioned close to the Sun. The project is divided into two phases: (1) studying electron acceleration during low solar activity, focusing on small-scale magnetic reconnection events, and (2) during heightened solar activity, concentrating on solar flares and Coronal Mass Ejections.

This work focuses on the first phase by investigating solar type III radio bursts on September 18, 2021, a day without sunspots. Type III radio bursts are caused by electron beams accelerated along open magnetic field lines and are typically associated with magnetic reconnection near sunspots. Preliminary results of this investigation are reported. We aim to uncover new insights into particle acceleration and transport from the Sun by examining major solar eruptions and subtle magnetic reconnection events. The outcomes of this research have significant implications for space weather forecasting, aiding in mitigating potential adverse effects on technology and human activities on Earth.

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