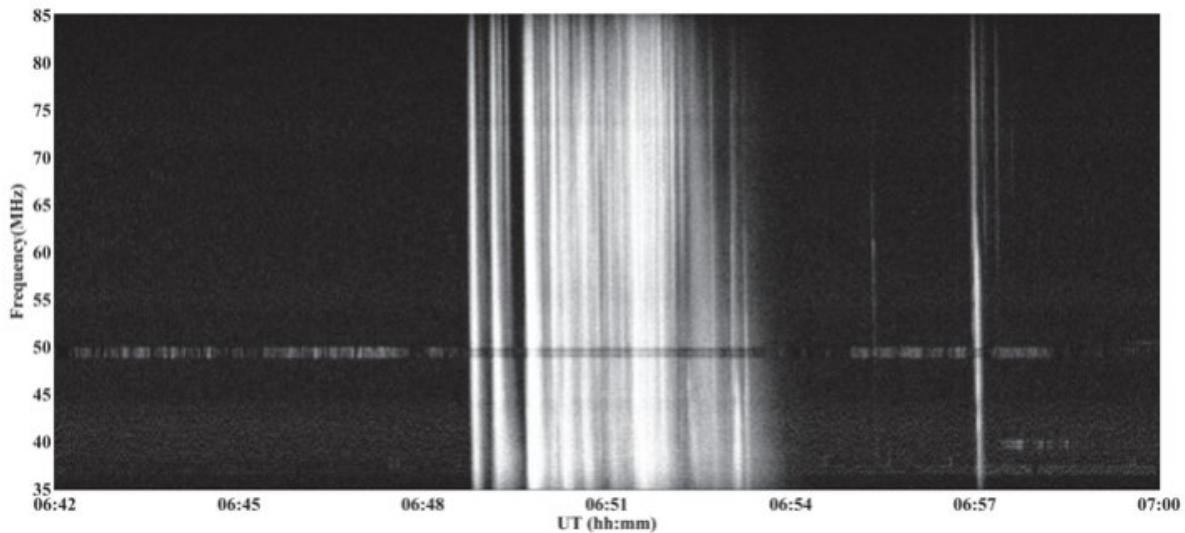


# New evidence for fragmentation of energy release in solar flares

July 29 2020



A Type III group observed by GLOSS. Credit: Ramesh et al, ApJL, 2020

Type III radio bursts from the sun are signatures of energetic ( $\sim 1\text{--}100$  keV) electrons, accelerated at the reconnection sites, propagating upward through the corona into the interplanetary medium along open magnetic field lines. The emission mechanism of the bursts is widely believed to be due to coherent plasma processes. The bursts are observed typically in the frequency range  $\approx 1\text{GHz--}10\text{kHz}$ , which corresponds to radial distance range between the low—upper corona; this implies that type III bursts can be used to trace the coronal magnetic field over the distance

range.

Type III bursts commonly occur in groups, and the individual bursts in a group are due to acceleration episodes occurring at different locations in the same active region ([Reid and Ratcliffe, 2014](#)). Observations showing displacements in the centroid of the type III burst during the course of the event are documented in the literature ([Vlahos and Raoult, 1994](#)). But reports on the correspondence between such changes and locations of the maximum emission in the associated H $\alpha$  [flare](#) (assumed to be the sites of the electron acceleration) are rare. Here, we present simultaneous observations of data from the Gauribidanur Radioheliograph (GRAPH) and the Kodaikanal H $\alpha$  data and look for positional shifts in them by inspecting the inter-pixel changes in the respective images.

The image depicted shows the GLOSS observations on 2015 January 14 in the time interval 06:42–07:00 UT. The intense patch of emission during  $\approx 06:48$ – $06:54$  UT corresponds to a group of type III bursts. The other separate similar bright and faint fast drifting features, but not as a group like the former, close to  $\approx 06:55:30$  UT and  $\approx 06:57$  UT are isolated type III bursts. There was an SF-class H $\alpha$  flare on the same day from the active region AR 12259 located at the heliographic coordinates S14W02. The flare was observed during the period  $\approx 06:49$ – $07:04$  UT with maximum at  $\approx 06:52$  UT.

There was also a C2.3-class GOES soft X-ray flare in the time span  $\approx 06:46$ – $06:57$  UT. Its maximum was at  $\approx 06:51$  UT.<sup>5</sup> A comparison of the timings indicates that the isolated type III bursts as well as the group of type III bursts occurred within the flare period. The positional shifts of the radio and H $\alpha$  images are traced using centroiding methods ([Kontar et al., 2017](#)). For the radio images, we generated maps using AIPS with pixel size of  $\sim 14''$ . This clearly indicates that the individual bursts in the type III burst group are due to spatial and temporal

fragmentation of the primary energy release near the flare site in the chromosphere as revealed by the H $\alpha$  observations. The observations of group of type III bursts are the coronal signatures of such a fragmented energy release.

The results are published in the *Astrophysical Journal Letters*, and have reported the first observational evidence for a correlation between the changes in the centroid positions of a group of type III radio bursts and that of the associated H $\alpha$  flare emission. Similar optical and radio observations with [high spatial resolution](#) would be useful to understand the topic of fragmented energy release better since it has been addressed mostly using time and spectral domain studies to date. The magnetic coupling between the levels in the solar atmosphere and how the energetic particles are guided through the corona into the interplanetary space could also be probed using such observations.

**More information:** R. Ramesh et al., New Evidence for Spatio-temporal Fragmentation in the Solar Flare Energy Release, *The Astrophysical Journal* (2020). [DOI: 10.3847/2041-8213/ab6a9c](https://doi.org/10.3847/2041-8213/ab6a9c)

Provided by Community of European Solar Radio Astronomers

Citation: New evidence for fragmentation of energy release in solar flares (2020, July 29) retrieved 10 April 2024 from <https://phys.org/news/2020-07-evidence-fragmentation-energy-solar-flares.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--