OVSA for space weather

Exploiting High sensitivity, Low-Latency, Radio Imaging Spectroscopy for Space Weather

Collaborators: NJIT New Jersey's Science & Technology University, Caltech, UC Berkeley

Funded by: NSF, NASA, Google Cloud

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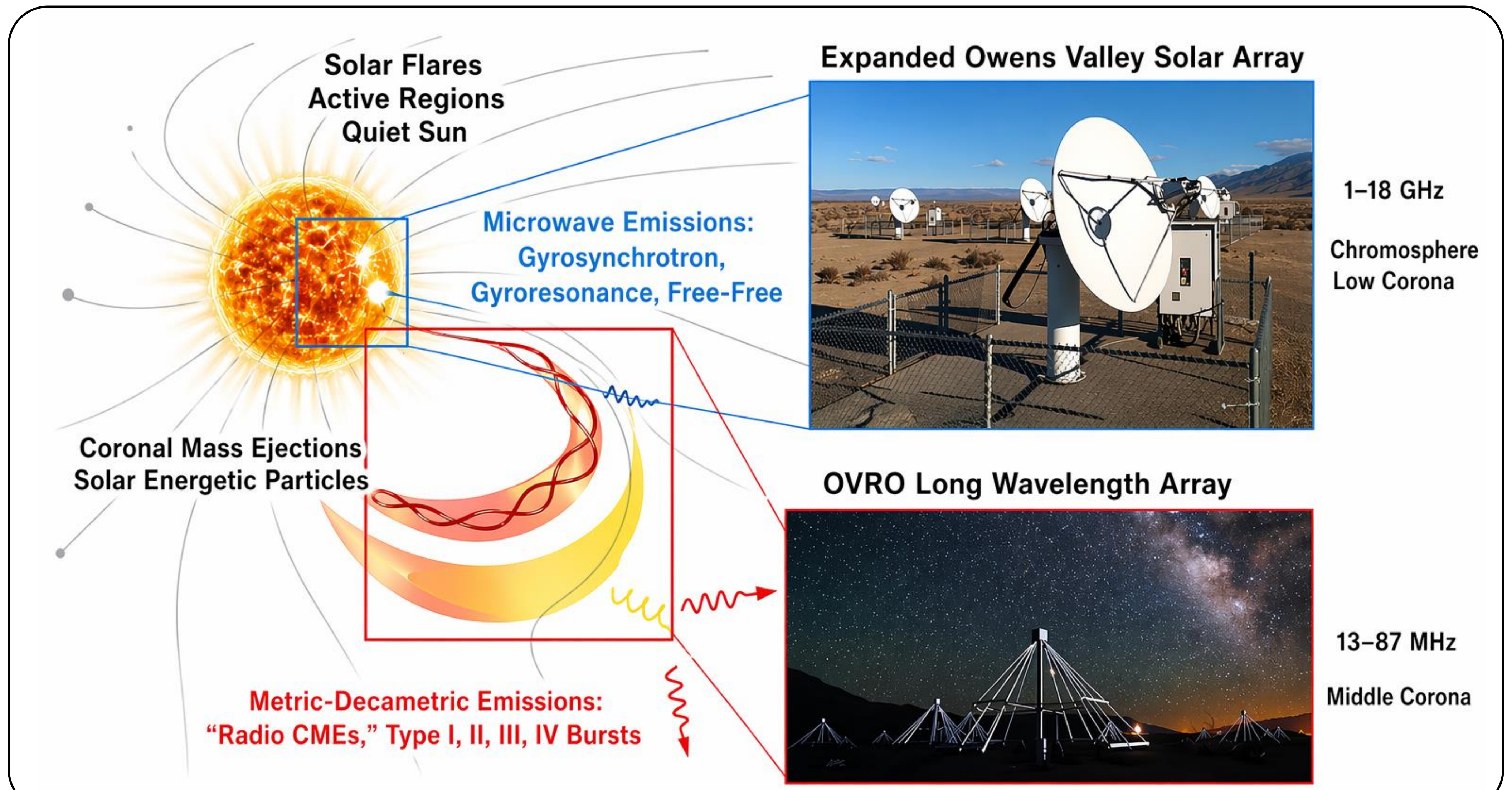


Data products

OVRO-LWA and EOVSA combined provide complementary radio data products for space-weather diagnostics. OVRO-LWA delivers all-sky dynamic spectra and imaging from 13–87 MHz, tracing Type II/III bursts that probe CME shocks and SEP-producing electron beams.

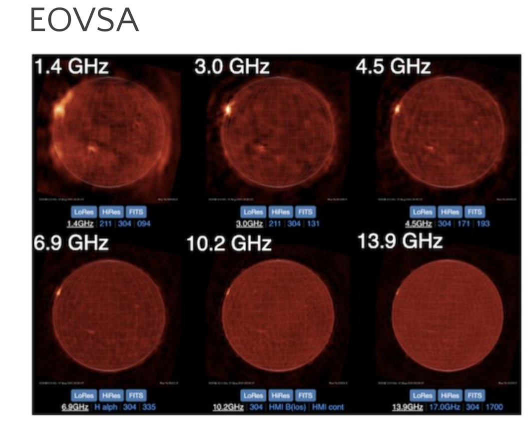
Table 1: Observing modes offered by EOVSA and OVRO-LWA.

Instrument	Mode	Bandwidth	δt (s)	$\delta\nu$	$\delta\theta^\dagger$	N_{ant}	Objectives
EOVSA(-15)	Standard Imaging	1–18 GHz	1	~40 MHz	5″	13(15)	Quiet Sun, flares, active regions
OVRO-LWA	Standard Imaging	13–87 MHz	10	24 kHz	5′	352	Synoptic; CMEs
OVRO-LWA	Burst Imaging	13–87 MHz	0.1	96 kHz	5′	48	Metric radio bursts
OVRO-LWA	Beamforming	13–87 MHz	0.064	24 kHz	-	256	Metric radio bursts

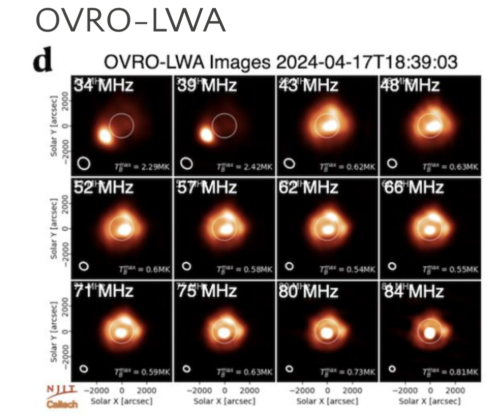
†Quoted angular resolution $\delta\theta$ values for EOVSA and OVRO-LWA are at 10 GHz and 80 MHz, respectively, which increase linearly with decreasing frequency.

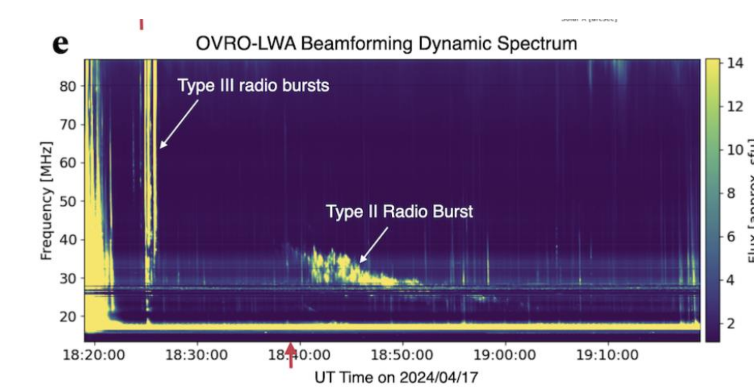
EOVSA extends to 1–18 GHz with spatially resolved microwave imaging spectroscopy. Both pipelines output calibrated FITS cubes, quick-look spectrograms, and event catalogs in near real time.

EOVSA

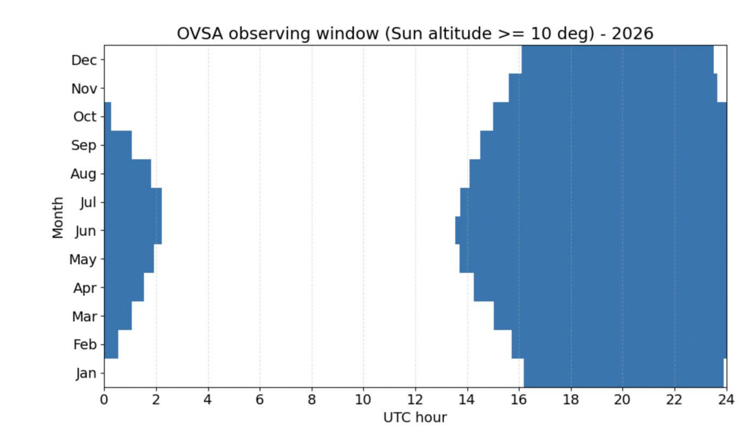


OVRO-LWA

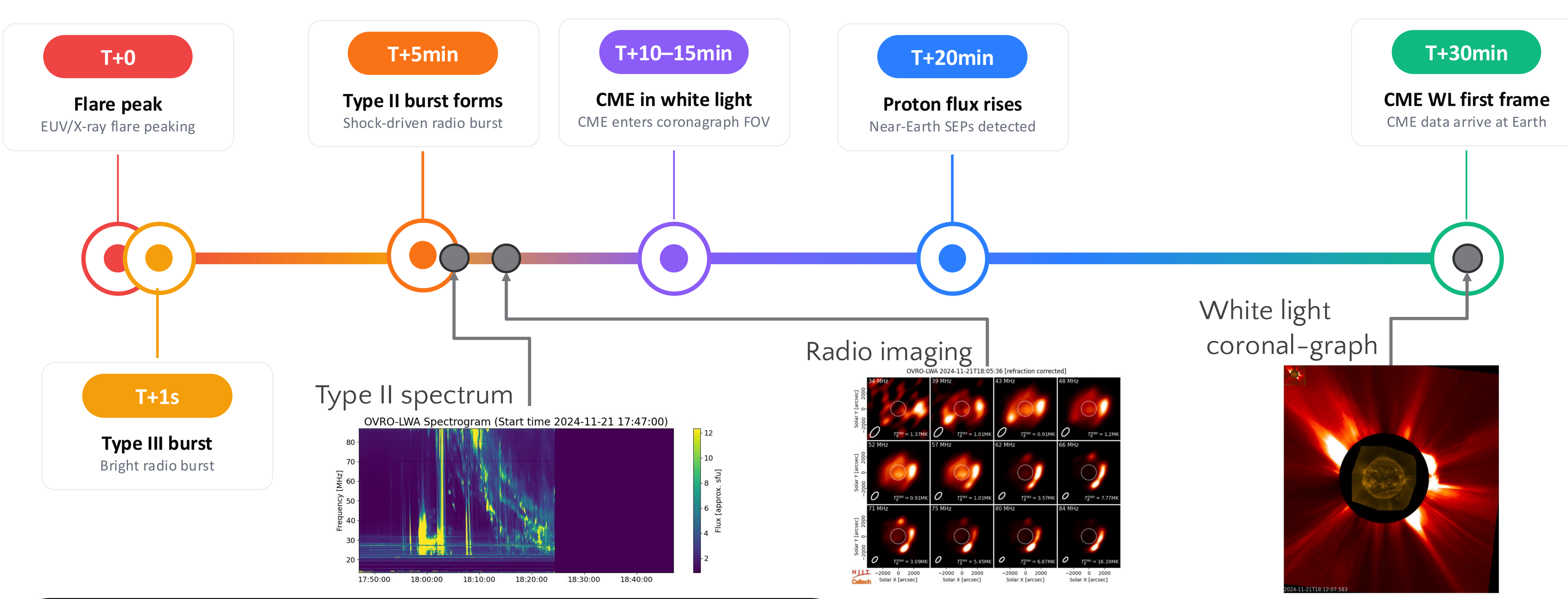




Availability



Life cycle of an earth impacting solar eruption



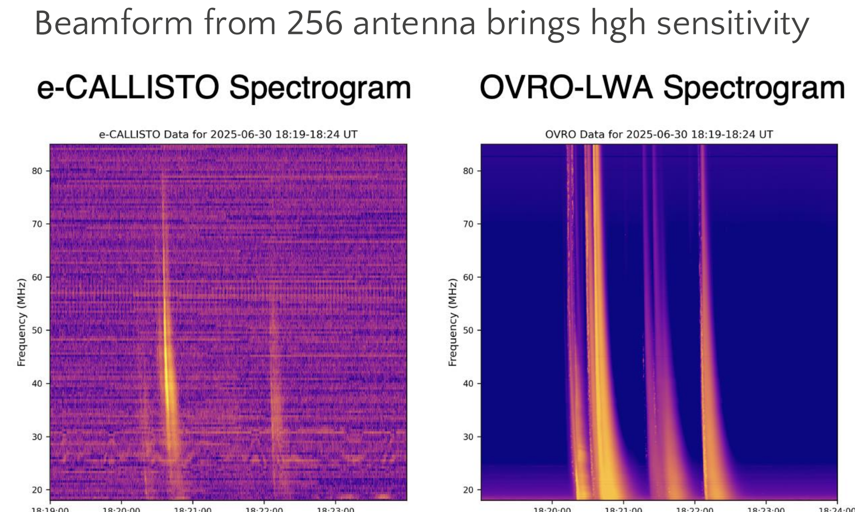
Key performance metrics for SWx

OVRO LWA

LATENCY	Dynamic spectrum data stream	**0.5** s
	Multi-frequency imaging (144 channel image, calibrated)	**3–5** min
SENSITIVITY	Dynamic spectrum	**<0.01** s.f.u
	Imaging brightness temperature	10^5 K
HISTORICAL AVAILABILITY		**>96%**

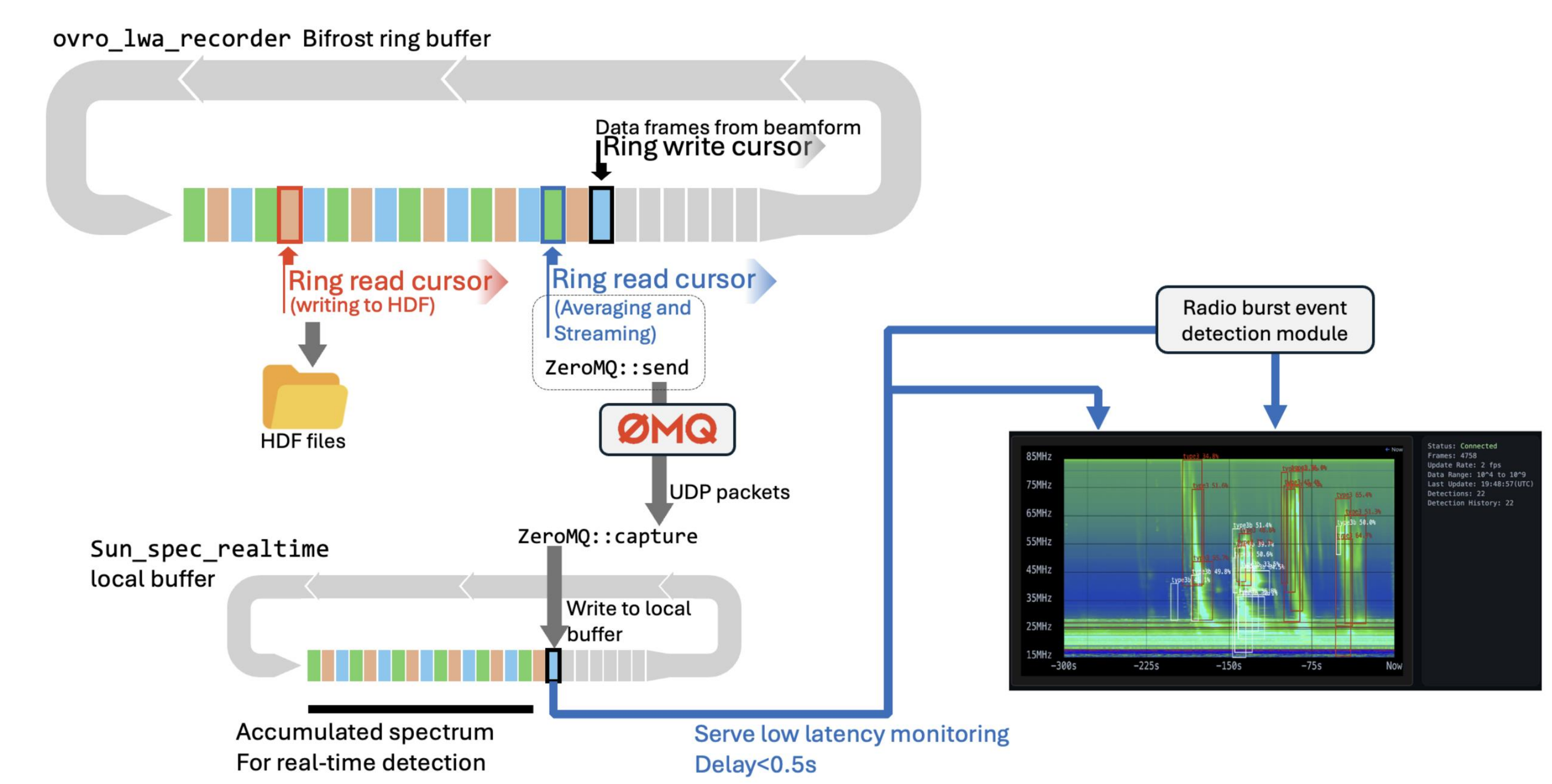
Radio observations can catch and report the early stage of the eruption first. With Type II bursts appear as soon as the CME driver steepens into a shock — typically minutes before the CME becomes visible in white-light coronagraphs and tens of minutes to hours before SEPs or geomagnetic effects arrive at Earth. This early, direct diagnostic of accelerated particles and shock formation gives forecasters a critical head start on SEP and CME impact warnings.

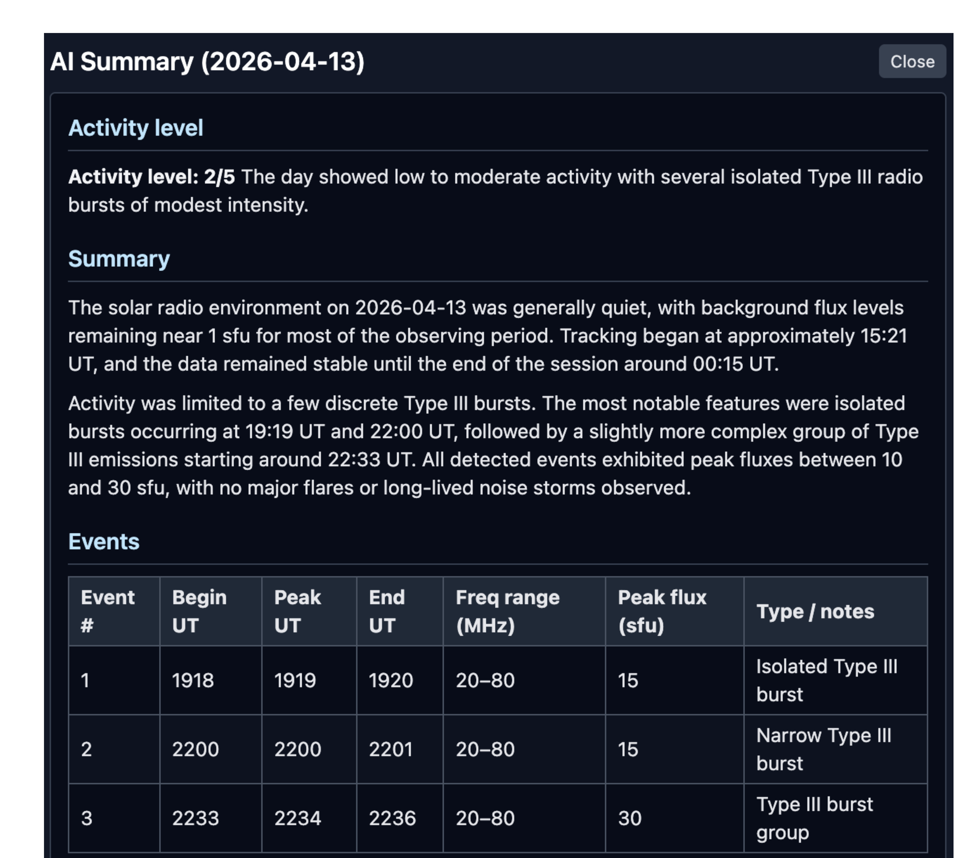
Beamform from 256 antenna brings hgh sensitivity



Realtime dynamic spectrum streaming and AI powered event detection and reporting

OVRO-LWA streams calibrated 13–87 MHz solar dynamic spectra within 0.5 of real-time, continuously monitoring the low-frequency corona and inner heliosphere where CME-driven shocks and SEP-producing electron beams emit. The low latency is achieved by directly reading from the buffer. The stream feeds a deep-learning classifier trained on historical Type II and Type III bursts, which flags candidate events in real time and auto-tags each detection with frequency drift, duration, bandwidth, and intensity. Confirmed events are pushed to a public dashboard, archived with quick-look spectrograms and FITS cubes, and delivered as machine-readable alerts (JSON/VOEvent) accompanied by an LLM-generated plain-language summary that contextualizes the burst for operational forecasters.





Arxiv 2603.25446

Live stream

Data portal