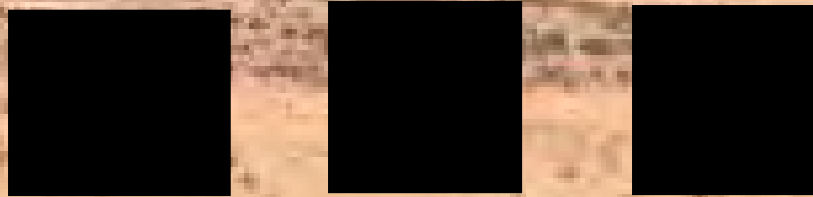


Investigating a Solar Burst with the MWA Prototype



Rachel Kennedy

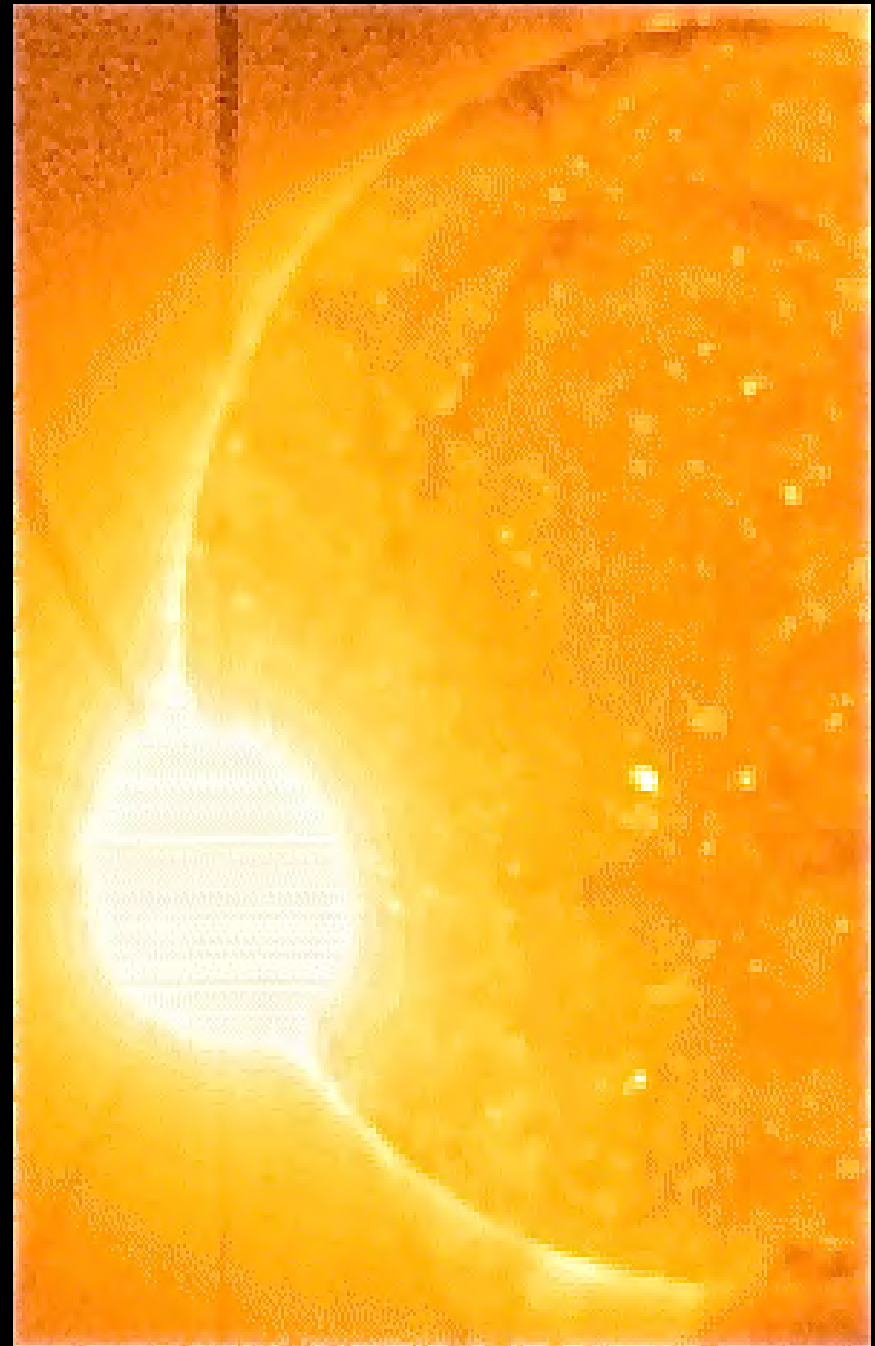
Advisers: **Lynn Matthews** and **Divya Oberoi**

MIT Haystack Observatory

REU Summer Program 2010

Outline

- The Murchison Widefield Array
- The Sun
- Observations
- Analysis
 - The Burst
 - Polarization
 - Imaging
- Conclusions
- Acknowledgements



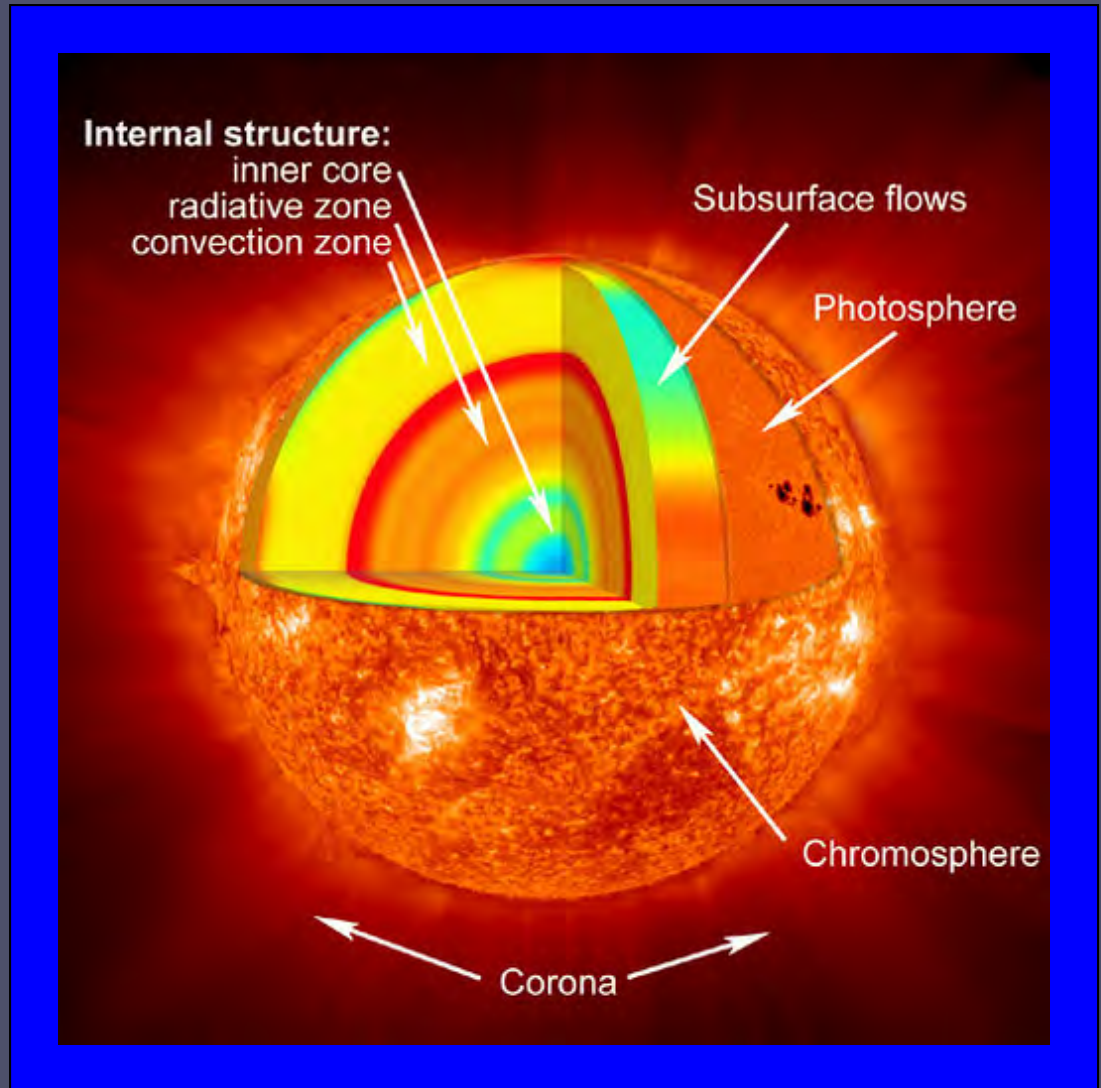
The Murchison Widefield Array

- Remote Western Australia
 - RFI Quiet
- Operates at 80-300 MHz
- 512 tile-design planned
 - Dual polarization
 - ~130,000 baselines
- 32 tiles are installed
- Imaging capabilities
 - Good snapshot capability



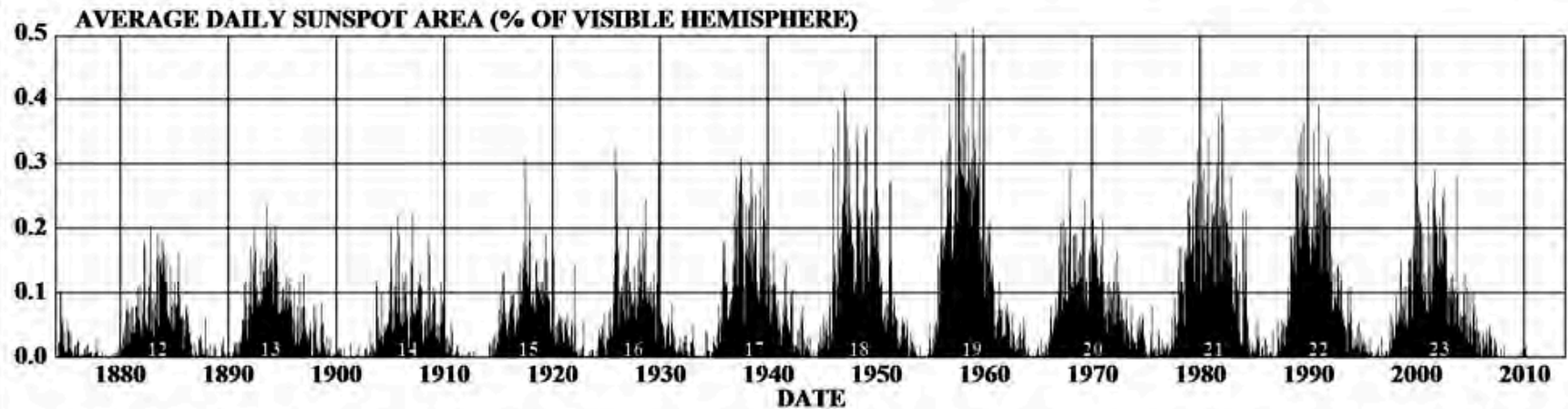
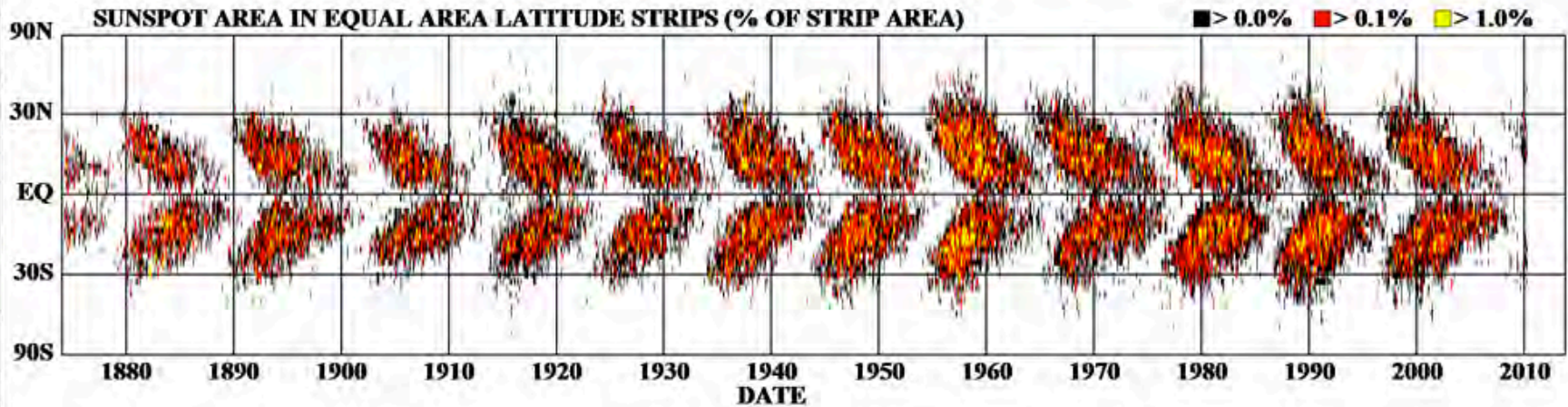
The Radio Sun

- Extends beyond optical disk
- 22-year solar cycle and current extended quiescence
- Thermal and non-thermal emission



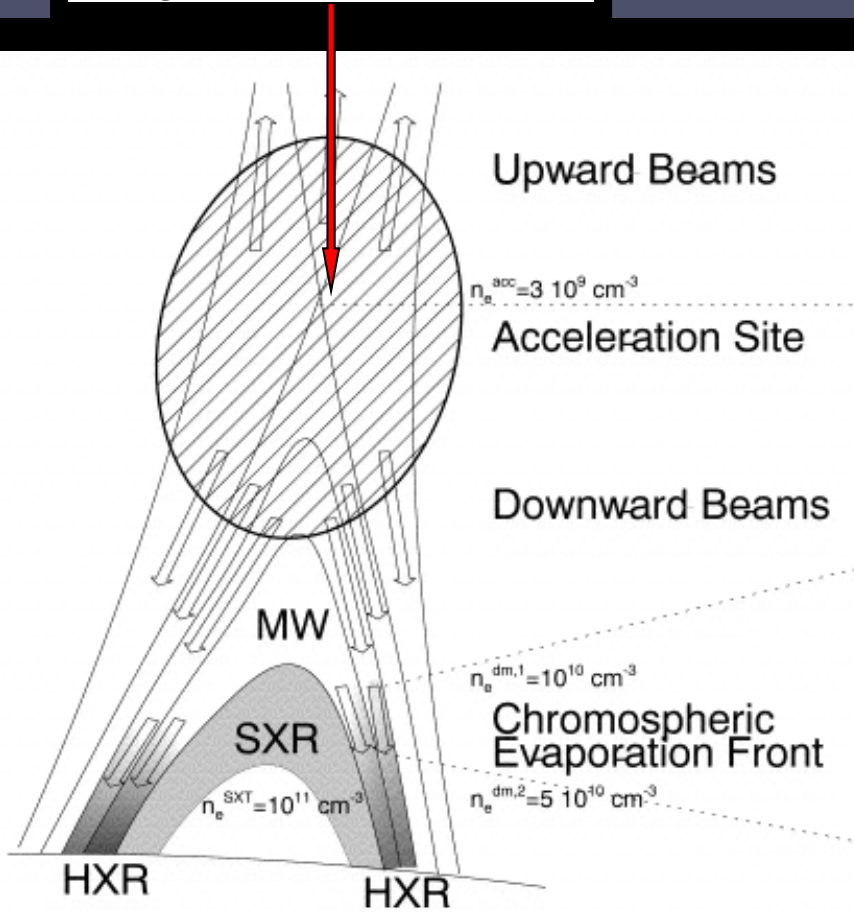
Solar Cycle

DAILY SUNSPOT AREA AVERAGED OVER INDIVIDUAL SOLAR ROTATIONS



Type III Bursts

Magnetic Reconnection



$$v \sim 0.1 \cdot c$$

$$v_p \propto n_e^{1/2}$$

Plasma emits

At Fundamental v_p
and Harmonic $2 \cdot v_p$

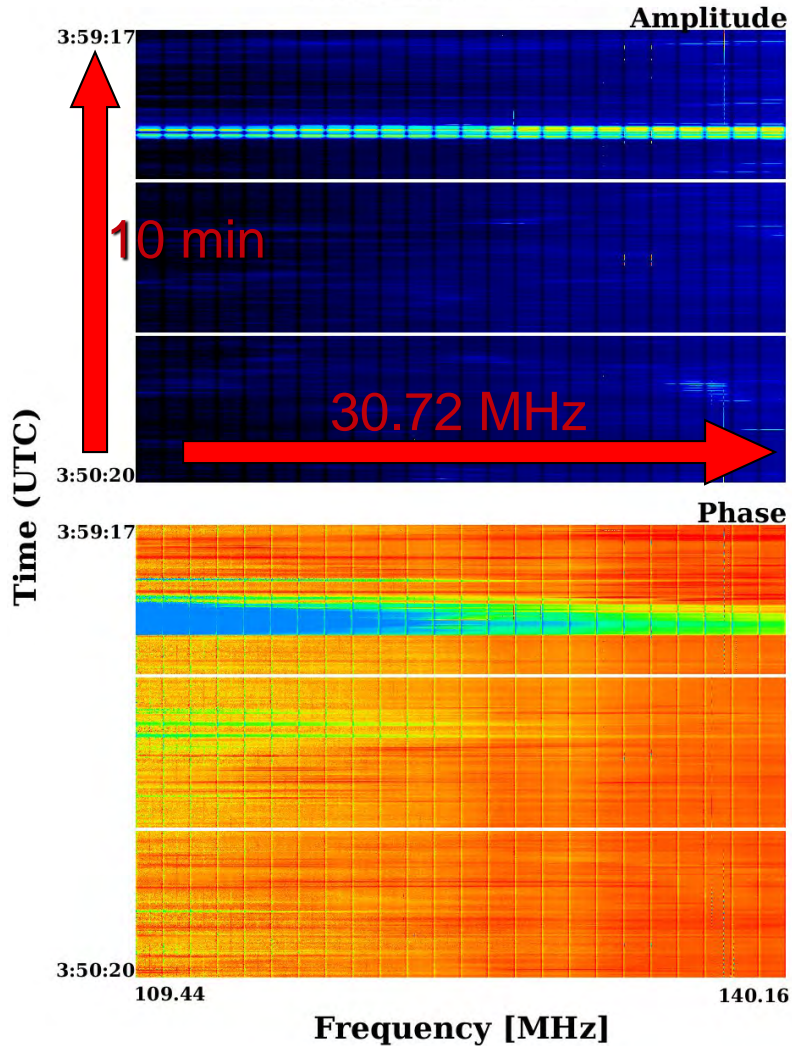
Scatter and Spread

Drift in Frequency
with Time

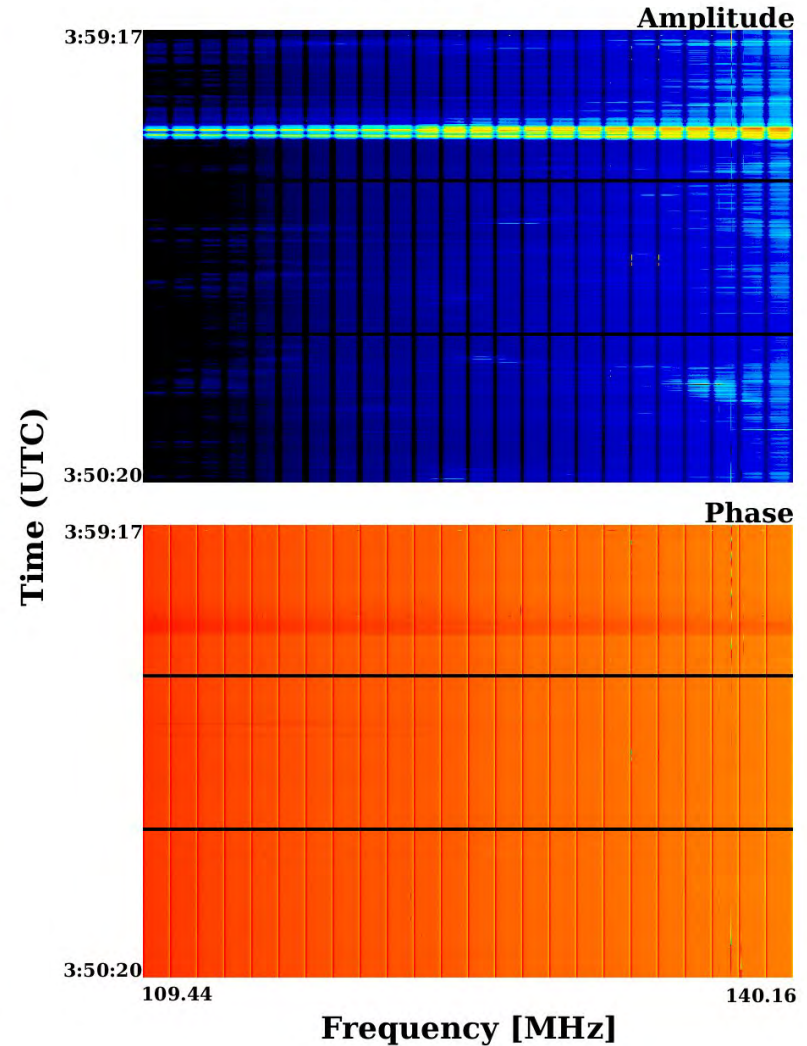
The Observations

Phase and Amplitude Plots

Baseline 5 -21

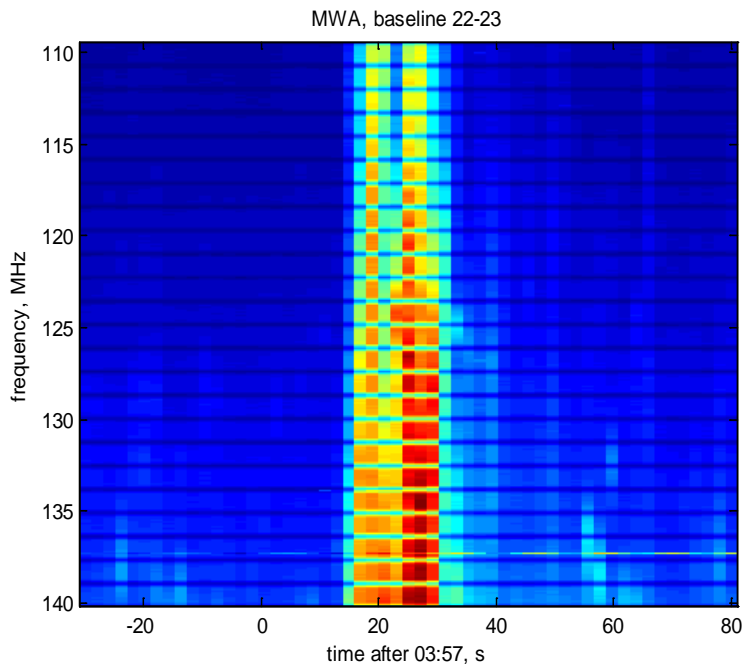


Baseline 14 - 15

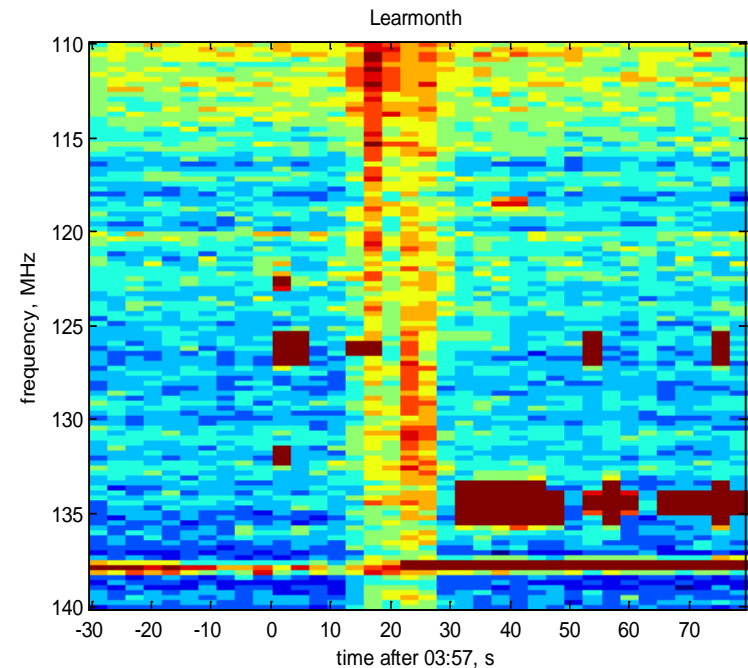


Observed With Learmonth

- MWA



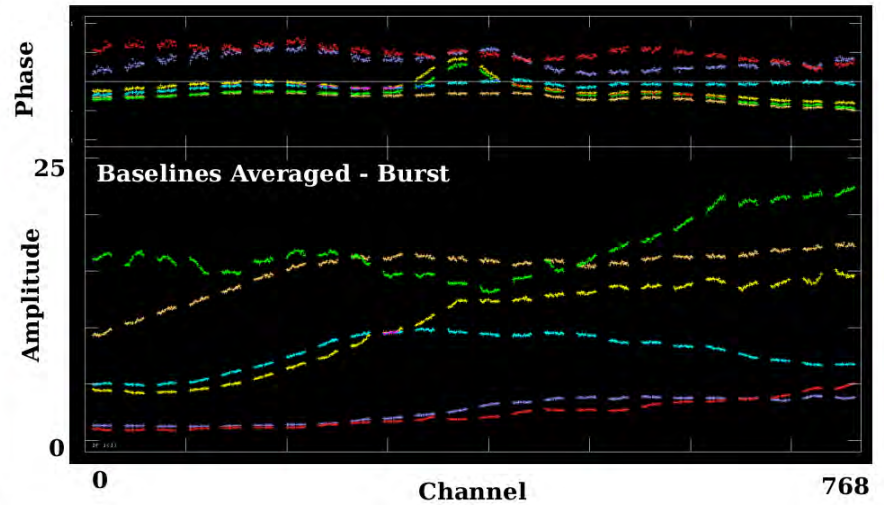
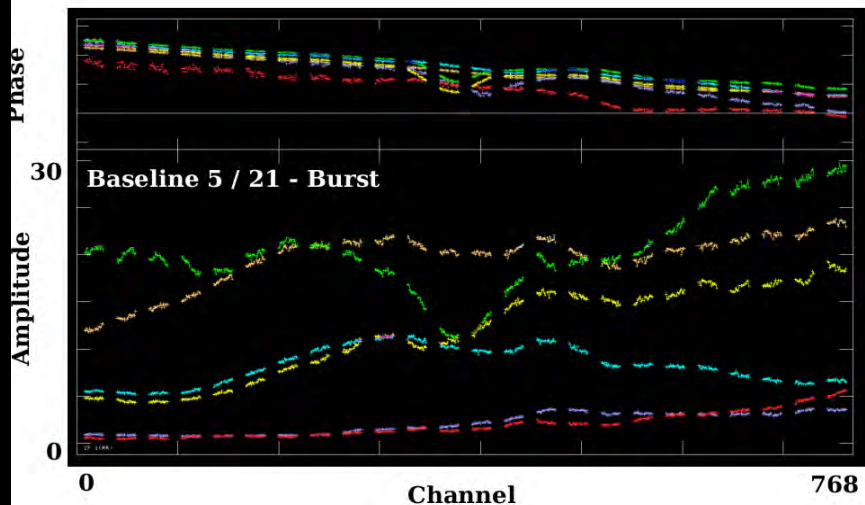
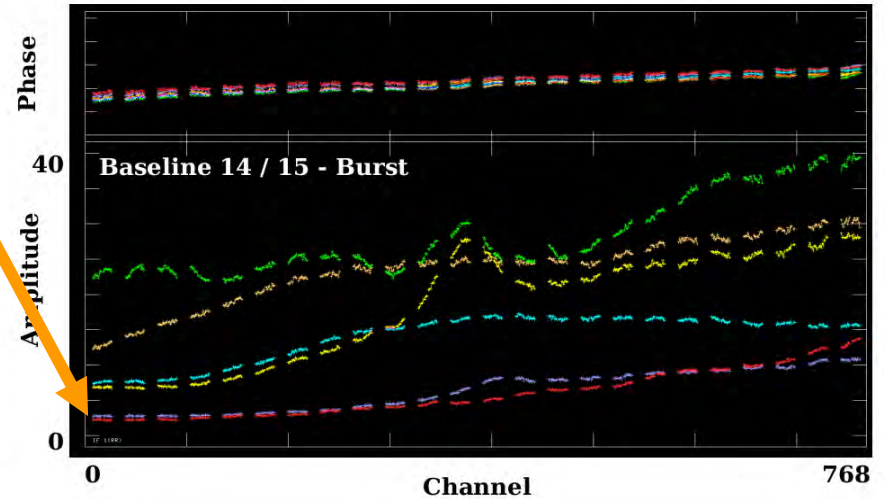
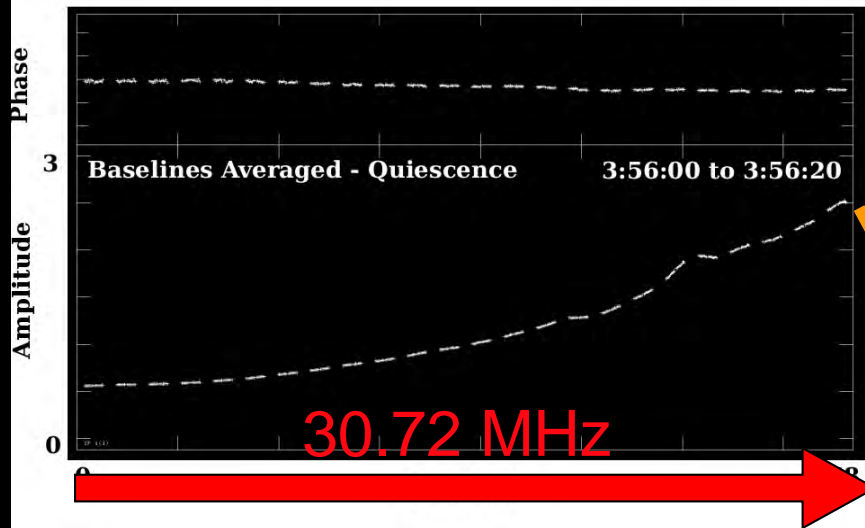
- Learmonth Solar Radiospectrograph



Images from Lobzin and Cairns, University of Sydney

Characterizing the Burst

Amplitude and Phase as Functions of Frequency During the Burst and Quiescence



3:57:14 3:57:18 3:57:22 3:57:26 3:57:30 3:57:34 UTC

Polarization

← 4 min →

109.44 MHz
114.56 MHz
119.68 MHz
124.80 MHz
129.92 MHz
135.04 MHz

QuickTime™ and a decompressor are needed to see this picture.

Burst
↓

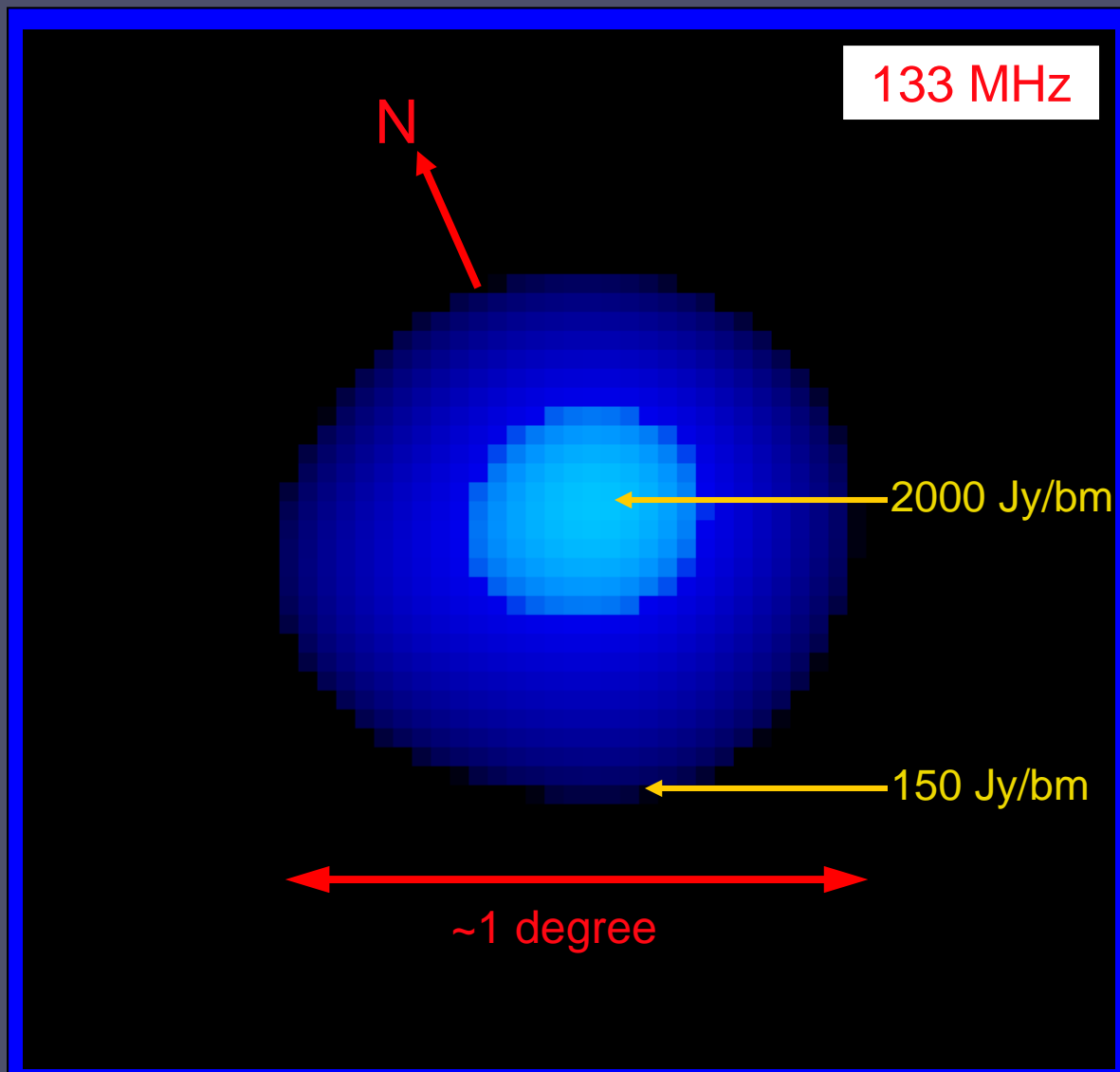
← 1.25

Image Processing

Dirty Map
133 MHz



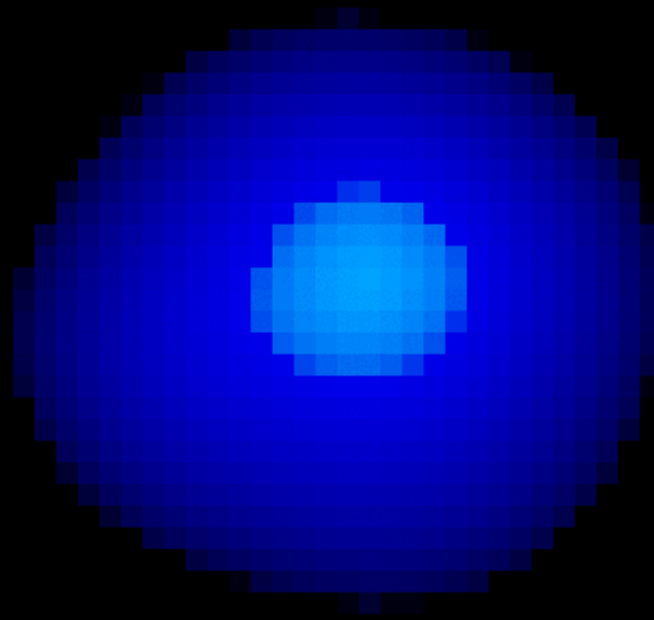
Final Clean Image



Imaging the Burst

2010March29

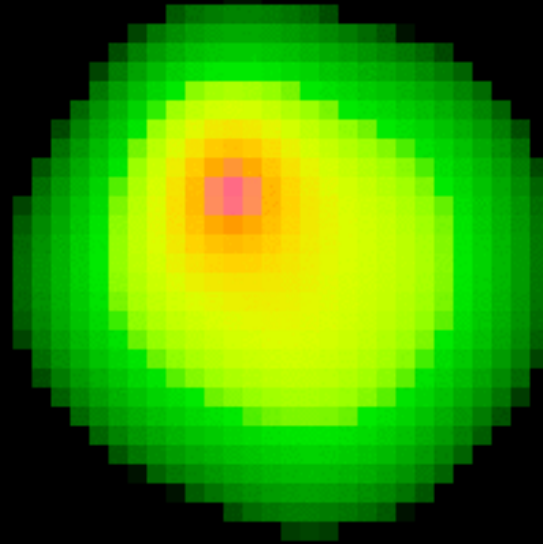
03:57:08UT



Comparison to March 27

2010March27

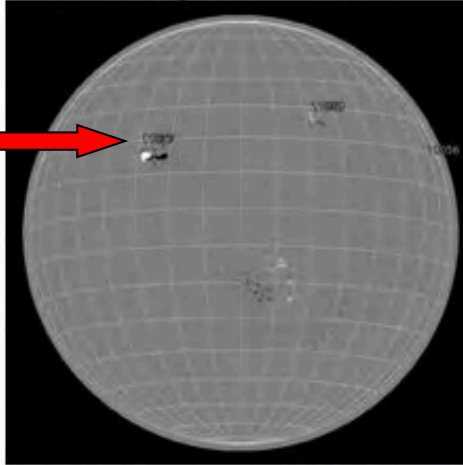
04:29:52UT



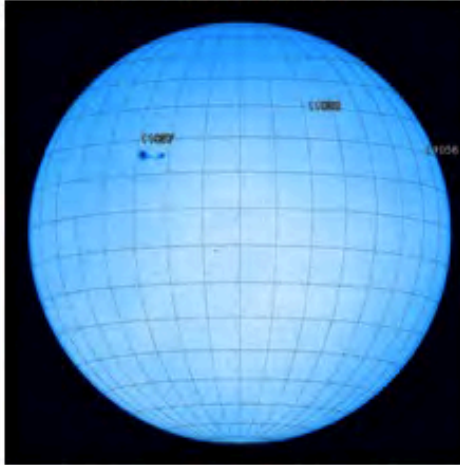
Movie created by Lynn Matthews

SolarMonitor Data - March 27, 2010

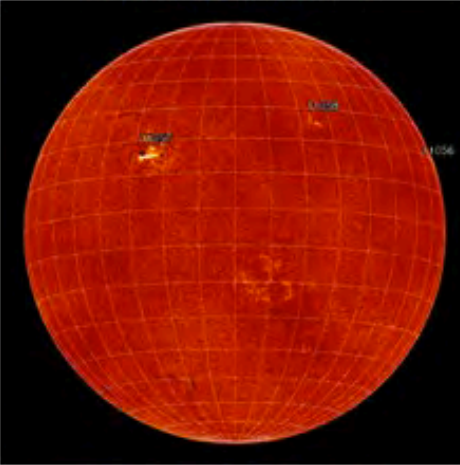
MDI Mag 20100327 08:29



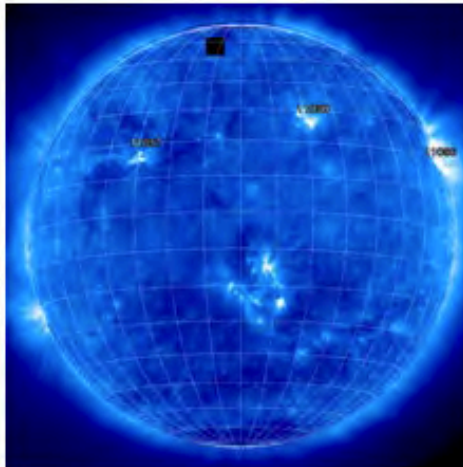
MDI Cont 20100327 08:00



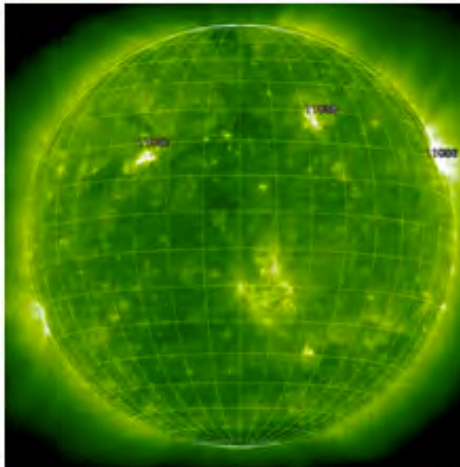
GHN H α 20100327 09:40



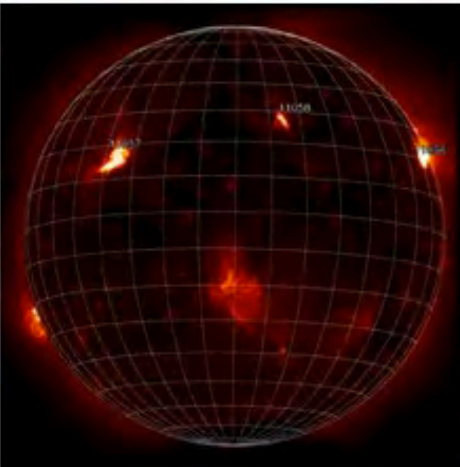
EIT 171Å 20100327 01:00



EIT 195Å 20100327 05:48

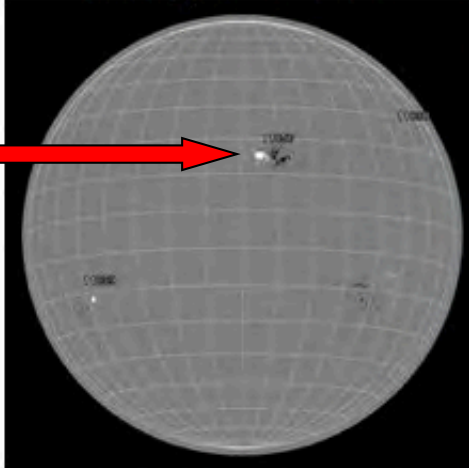


XRT 20100326 17:08

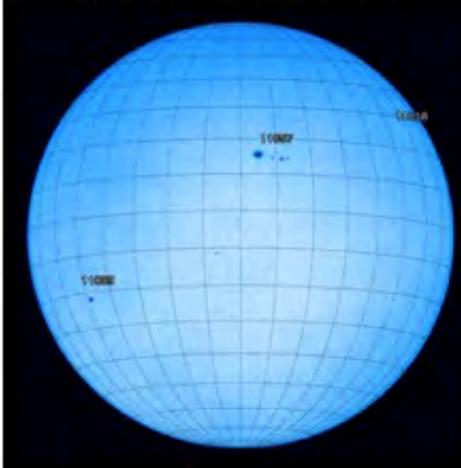


SolarMonitor Data - March 29, 2010

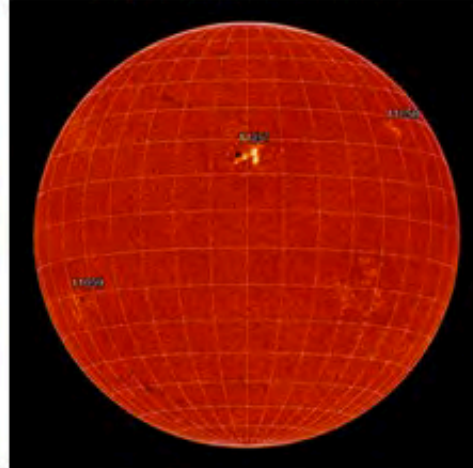
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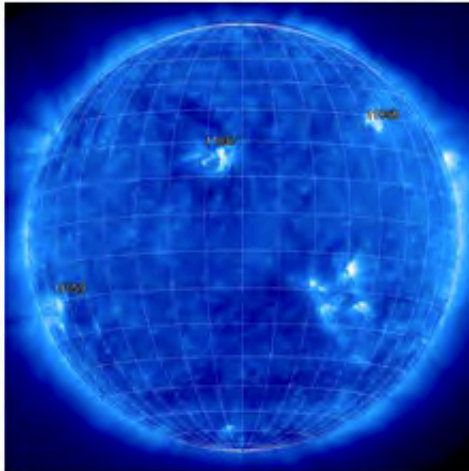
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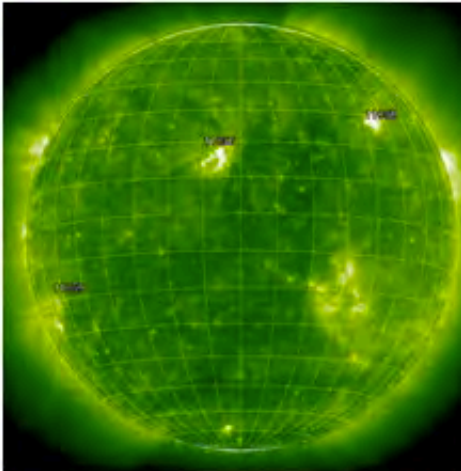
GHN H α 20100329 08:17



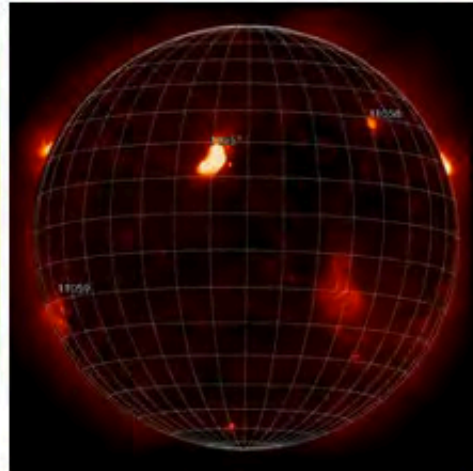
EIT 171Å 20100329 19:00



EIT 195Å 20100328 19:25



XRT 20100328 18:04



Conclusions and Future

- The MWA Will Help Challenge Current Standard Models
- Burst Structure is Complicated
- Comparison with Other Bands
- Need Additional Information and Calibration!

Acknowledgements

- Lynn Matthews
 - Divya Oberoi
 - KT Paul
- Madeleine Needles
 - Vincent Fish
 - Richard Crowley
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