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FOR ALL-SKY ASTROPHYSICS

The Murchison Widefield Array time domain overview



Martin Bell and Tara Murphy on behalf of the MWA transients collaboration.

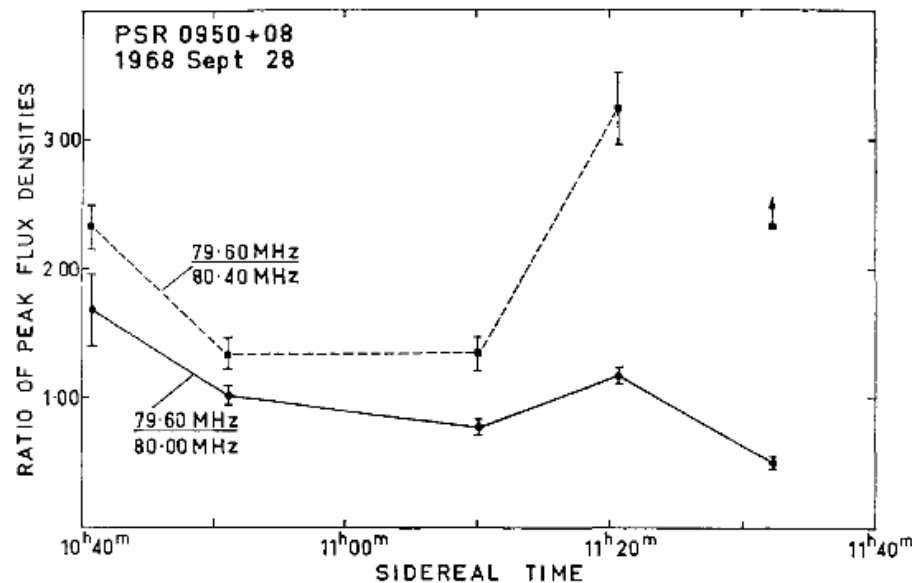
◆ **Bruce's legacy – some of his first author papers related to the time domain:**

- “A survey for metrewave variability in extragalactic radio sources”, 1988.
- “Scintillation of a radio source observed through the tail of Comet Halley”, *Nature*, 1987.
- “Flux densities, spectra and variability of pulsars at metre wavelengths”, 1986.
- “Microwave emission from flare star AT MIC”, *Nature*, 1981.
- “80 MHz Observations of the Scorpius X-1 Source”, *Nature*, 1971.
- “Temporal and spectral variations in the amplitudes of three pulsars at 80 MHz”, 1969.
- “Long Baseline Interferometry of Jovian Decametric Radio Bursts”, *Nature*, 1963.
- “Radio Scintillations of Satellite 1958 α ”, *Nature*, 1958.

- ◆ **Low mass stars and brown dwarfs**
Physical origin; incident rates; spectral characteristics
- ◆ **Magnetars**
Flare properties; energetics; duty cycles of radio bright phases
- ◆ **X-ray binaries**
Understanding the disc-jet connection; outburst statistics; burst luminosity function
- ◆ **Extra-solar planets**
Independent radio detections?
- ◆ **Gamma Ray Bursts**
Prompt emission; long term follow-up
- ◆ **Multi-messenger astronomy Gravitational waves, neutrinos**
- ◆ **Pulsars**
Interstellar scintillation, continuum detection of previous unknown pulsars
- ◆ **AGN, blazars**
- ◆ **New discoveries**

See Bowman et al. 2013, PASA, 30, 31

- “Temporal and spectral variations in the amplitudes of three pulsars at 80 MHz”, 1969.



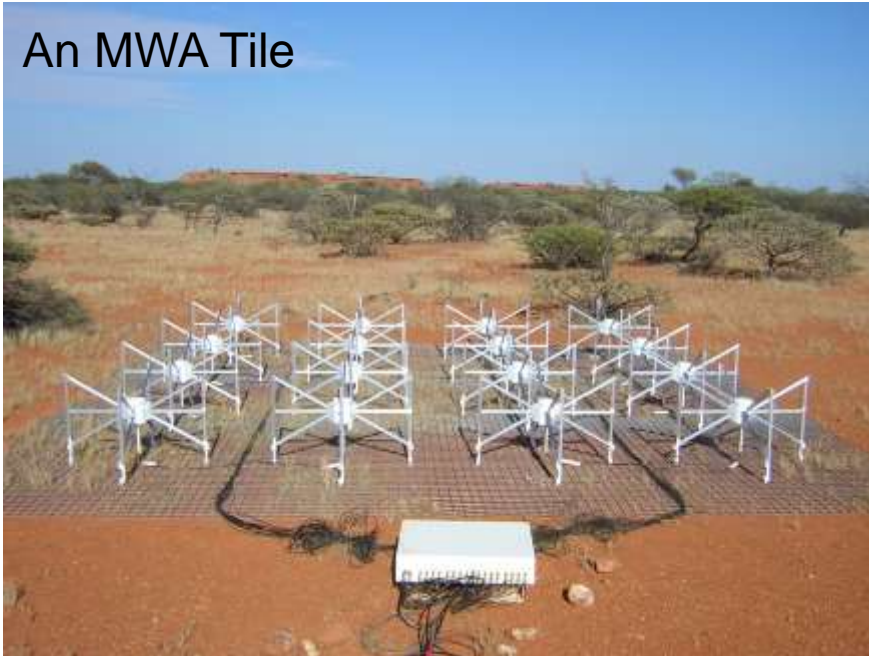
More on PSR
J0953+0755
later.....

Figure 2. Slow changes in the relative pulse amplitudes from PSR 0950+08 on three closely spaced frequencies near 80 MHz are illustrated by the two independent ratios $(79.60 \text{ MHz}) / (80.00 \text{ MHz})$ and $(79.60 \text{ MHz}) / (80.40 \text{ MHz})$. Each point is an average obtained from the strongest pulses recorded in an interval of 3-4 min. The rms dispersion associated with each average is shown by vertical bars. The aerials accepted circular polarization.

The Murchison Wide Field Array (MWA)

- › A low frequency array in WA.

An MWA Tile



Vital Stats:

Tiles = 128

Dipoles = 2048

Frequency = 80 to 300 MHz

Bandwidth = 30 MHz

Resolution = ~ 1 arc min

Max Baseline = 3 km

Field of View = 2000 deg^2



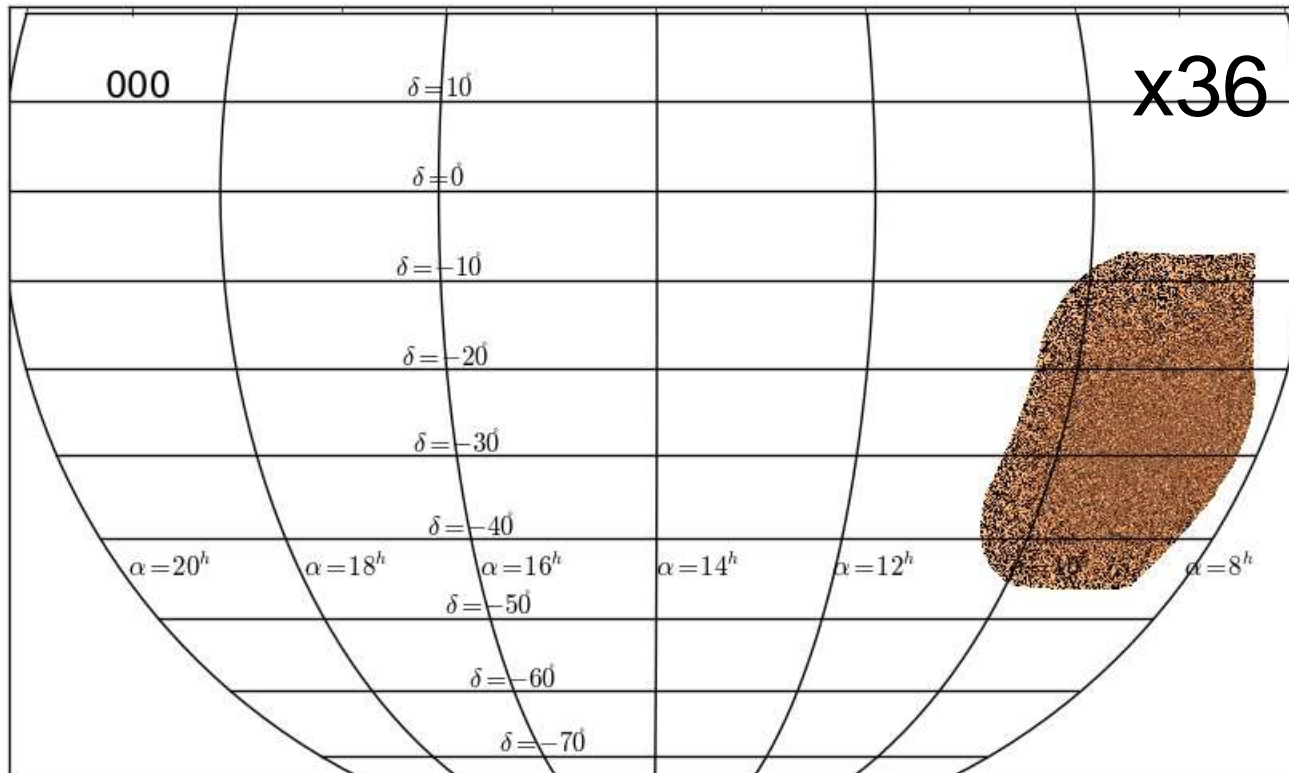


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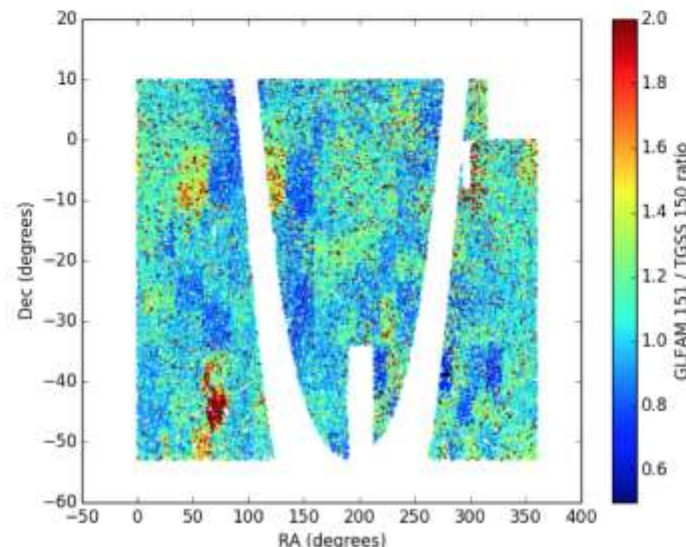
Common MWA observing strategy



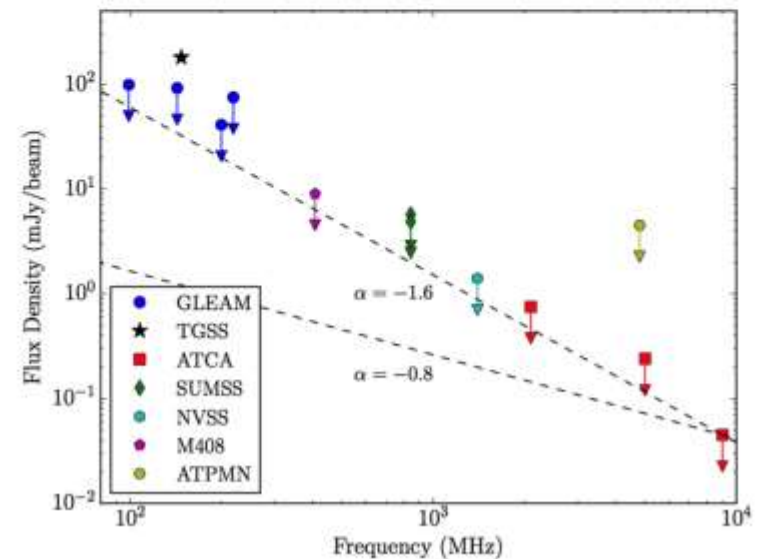
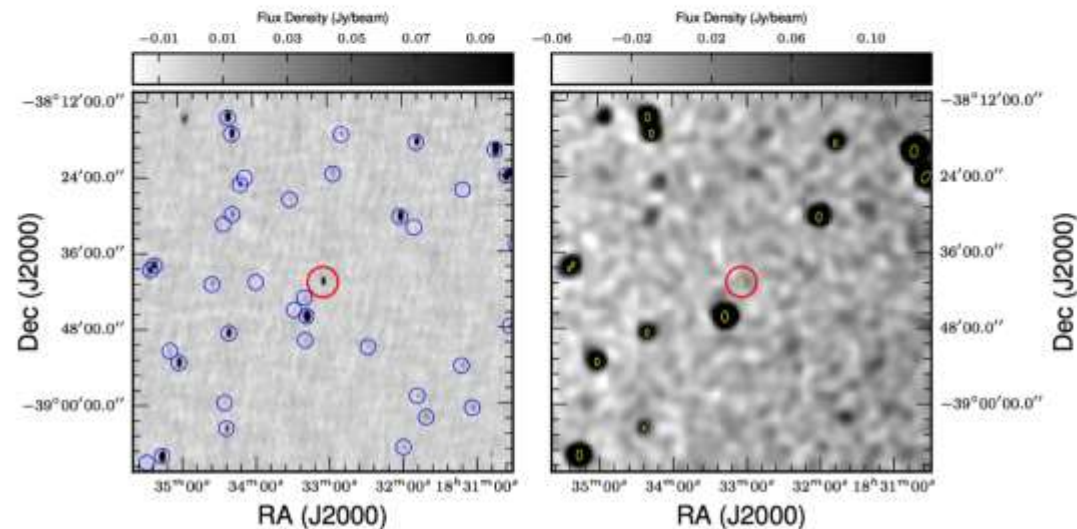
- Survey length ~ 4 years.
- A blind low frequency census of the low frequency time-domain sky.



- ▶ TGSS ADR: 150 MHz survey with GMRT reprocessed by Intema et al. (arXiv:1603.04368)
- ▶ $\sim 250\,000$ sources in overlap between TGSS and GLEAM
- ▶ Selected compact sources above 100 mJy
- ▶ Cross-matched and eyeballed sources with no counterpart
- ▶ Most were extended in TGSS or detected in other surveys

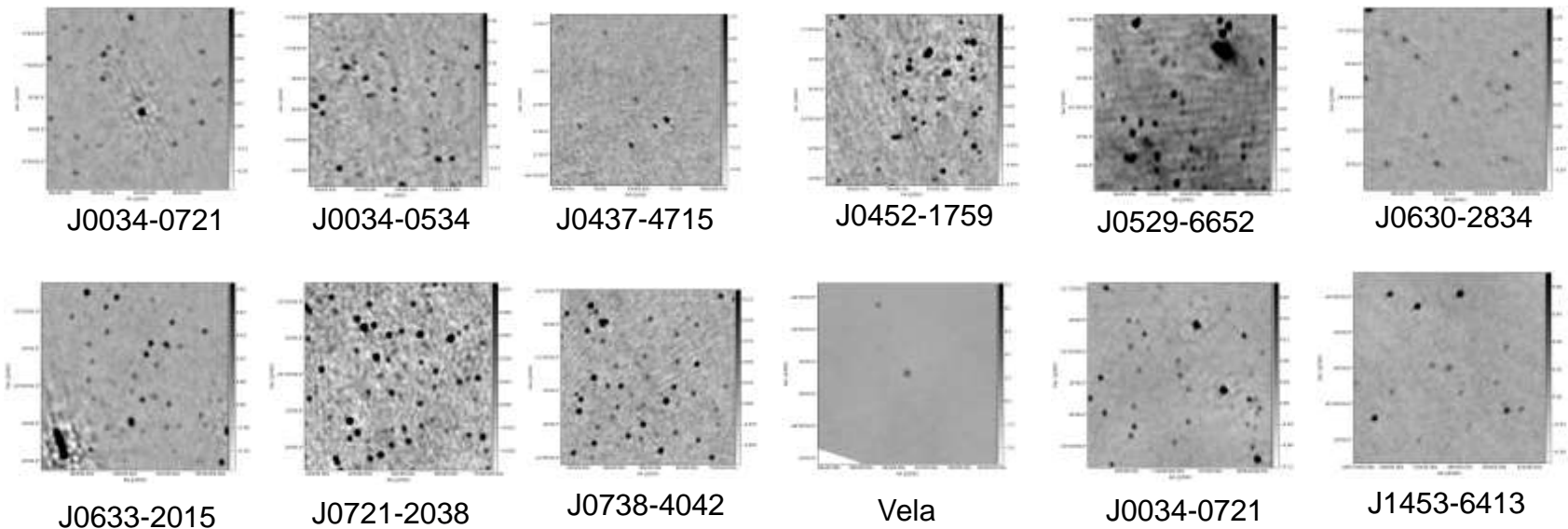


- ▶ 304 mJy (182 mJy) in TGSS, not detected in GLEAM
- ▶ Not detected in archival radio observations
- ▶ Not detected in ATCA follow-up
- ▶ Most likely: AGN flare or scintillating AGN



- * The MWA is a great instrument to study pulsars.
- * ~60 detections above 5 sigma.
- * ~17 detections bright enough to generate light curve statistics.
- * Some examples below.
- * See Murphy et al (2016) for full catalog using GLEAM .

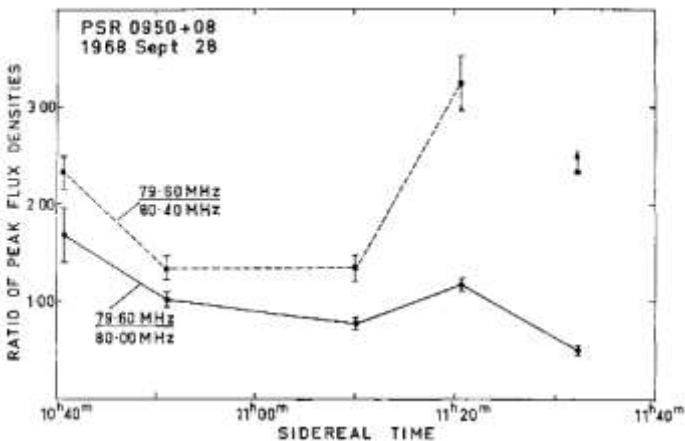
Mosaic images



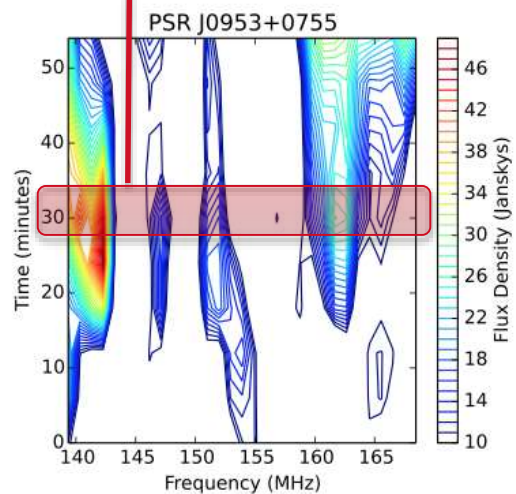
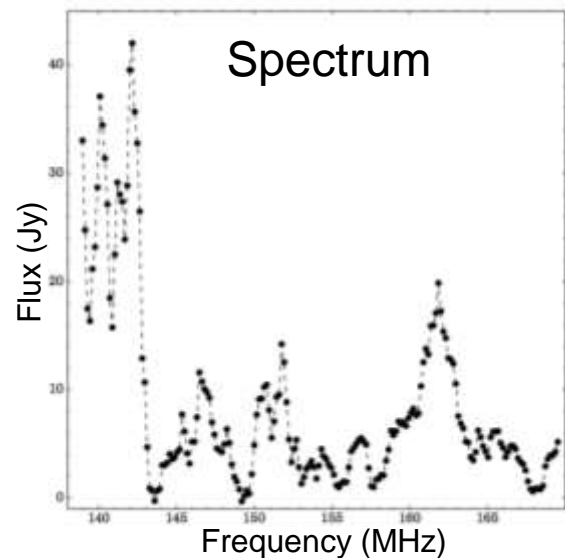


- Spectacular variability.
- Pulsar J0953+0755.
- Bell et al. (2016)

1969

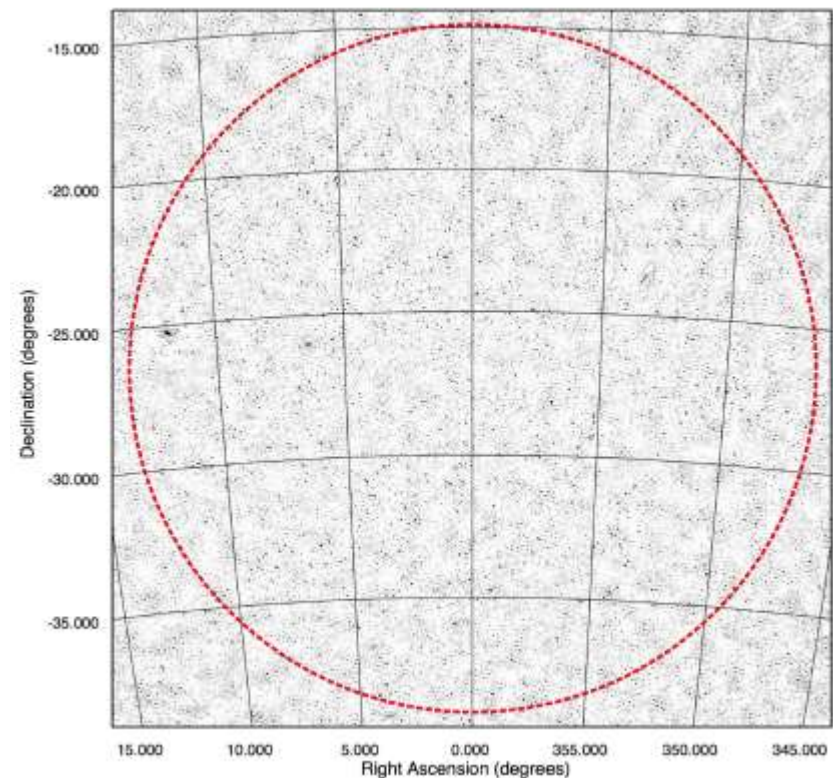
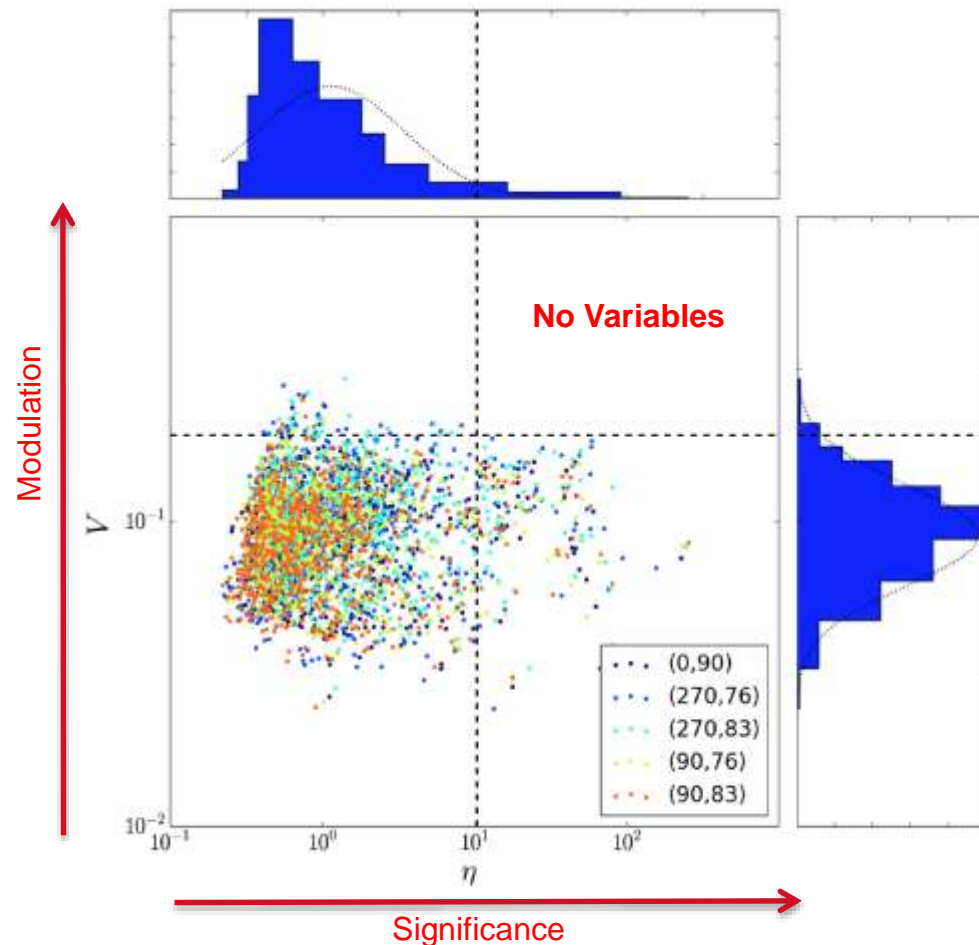


Variability in frequency



80 KHz spectral cube

- Rowlinson et al. (2015).
- 100 hours of data.
- No highly variable sources found.
- No transients found: limits placed on FRBs.





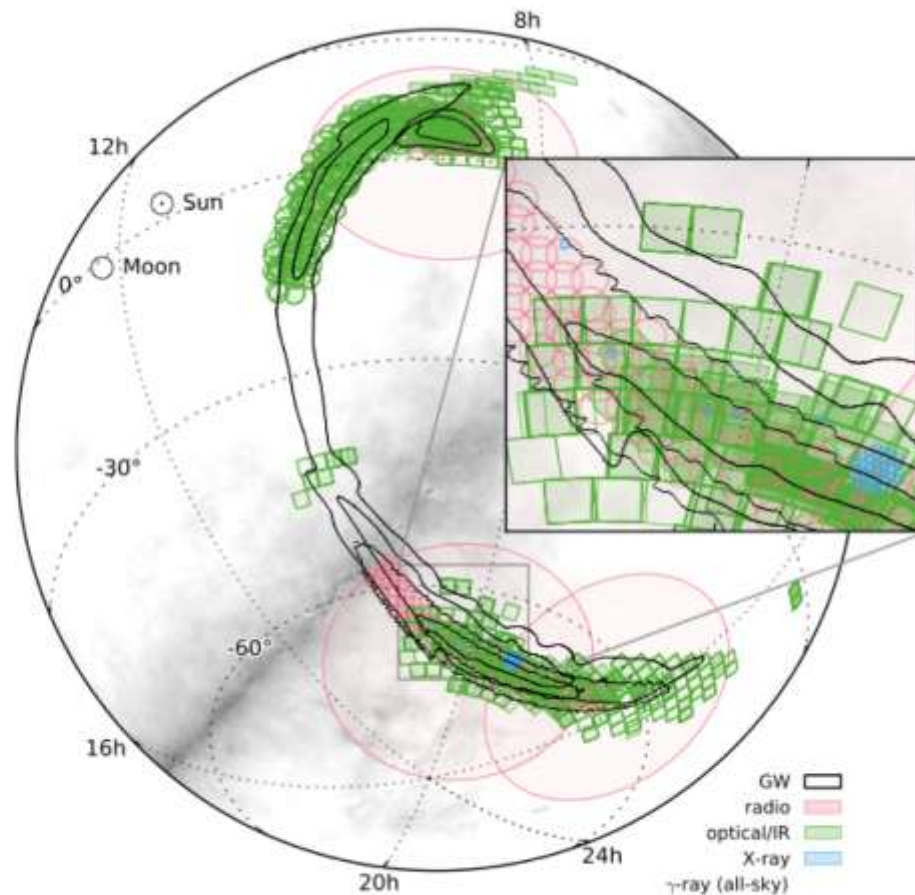
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Triggered observations

Triggering the MWA

- **Highlight:** The first gravitational wave GW150914
- We have also triggered on GRB's, neutrino + an assortment of other transients.



- ◆ Galactic centre monitoring (Kaplan, Miller-Jones, Croft et al.)
- ◆ Galactic plane survey (Kaplan, Miller-Jones, Croft et al.)
- ◆ LIGO O2 run in later 2016 (Kaplan et al.)
- ◆ Multi-messenger: neutrinos (Croft et al.)
- ◆ Fast radio bursts (Kaplan, Tingay et al.)
- ◆ Triggering real-time follow-up (Williams et al.)
- ◆ Higher time resolution blind survey (Murphy et al.)
- ◆ Pulsar variability (Bell et al. 2016)
- ◆ Flare stars and exoplanets (Lynch et al. — see talk later)
- ◆ All-sky transients and variability search (Bell et al.)
- ◆ And more

For the occasional break from this monotonous work, John (who usually co-opted me) began planting many square metres of couch grass to stabilise the sandy soil about the block-house, since sand in the rooms and in the equipment was a continual problem. We also embarked upon a program of ditch-digging to channel the stormwater down to the cliff edge at points well away from the block-house. The chemical toilet also needed our frequent attention. As summer approached, Gordon, John and I would often spend an hour at the end of the day surfing at nearby Bondi Beach. Such simple diversions and pleasures made the rather isolated life at Dover Heights more than tolerable.





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A Sunday stroll



Instagram

Search



jadepeace

Following

inhumanitywetrust_, leawantsless, 1d
fotofactory, oboss1, odd_insta, jessedede
and lilamsashafierce like this

jadepeace Prof @belletron81 took us on
an educational trip to an old radio astrology
site and read our future in the sky. At least I
think that's what he was yabbering on
about 😊 with @odd_insta
#thisguyhasaphd #sundaystroll
#astronomynerd #radiowaves #cliffwalk

belletron81 I am a Capricorn and
because Mars is in retrograde it means,
that, unfortunately, you and Ollie are
~~retards~~



Add a comment...

