LWA Update & Plans

Greg Taylor (UNM)
On behalf of the LWA Collaboration

LWA Users Meeting, 6/2/2023

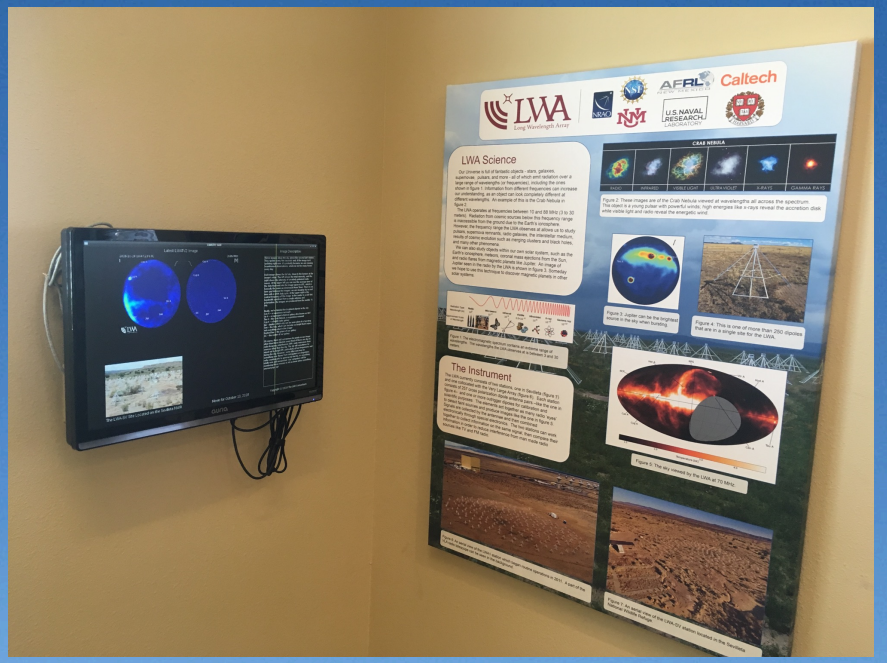
Meeting Logistics

- Restrooms down the hall past room 1010
- Water bottle refill available at water fountain
- Dinner in the Lobby ~6pm, Pasta, Pizza and Salad
- The session chair will provide a two-minute warning at T +13 min
- After T+15 min you are into your Q&A time

• Please e-mail me a PDF of your slides following your presentation if you don't want me to use what is on the presentation computer

LWA Outreach

- LWA-TV now has 3 channels, soon to be 4 (GUI available in LSL)
- LWA-TV running at Sevilleta, PAIS, VLA Visitor Center, NRL, ERAU, others?
- LWA demos/tutorials
  - Pulsar B0329+54
  - Unknown Pulsar
  - Pulsar Rotation Measure
  - Jovian Burst
  - Solar Burst
  - Crab Pulsar Giant Pulses
  - All-Sky Meteor Echoes
  - Single Baseline Interferometer
- Docker containers now available
- LWA interactive sky maps:



http://fornax.phys.unm.edu/low-frequency-sky/index.html
https://fornax.phys.unm.edu/multi-wavelength-sky/index.html

LWA Store

- Vehicle for providing equipment or services
- Still working on software licensing for DLITE
- In stock:
  - DLITE station (4 antennas, radios, cabling, etc.)
  - Swarm station (64 antennas, ARX, ADP, etc.)

Current Support

- Mid-Scale Innovations Program (NSF) – ends 8/31/2023
- EPIC Imager and Transients (NSF) – ends 8/31/2024
- Bifrost Cyberinfrastructure (NSF) – ends 6/30/2024
- Ionosphere and Transients (NRL) - ends 7/31/2024
- LWA Technology Upgrades (NASA) – ends 5/31/2025
- Ionospheric Research (AFRL) – ends 7/31/2025
- LWA Center at UNM (unrestricted)
- LWA Store (Caltech, UTD, TTU)

Current Staff

Faculty:

Jayce Dowell
Ylva Pihlstrom
Greg Taylor

Postdoc:

Sarah Chastain

Adjunct Staff:

Ken Obenberger
Frank Schinzel

Research Engineer:

Hiring in progress

PhD Students:

Seth Bruzewski
Logan Cordonnier
Pratik Kumar
Evan Sheldahl
Craig Taylor

Undergrads:

Jesus Aguilar
Lily Wood

Projects

~60 observing projects ongoing
Cumulative: 100+ users from 40 institutions and 4 countries

CFP12 deadline late October 2023
Note only LWA-SV will be available in CFP12
LWA1 undergoing retrofit in 2024
LWA-NA commissioning in 2023-2024

CFP12 observing begins January 1, 2024

CFP11

CFP: 11

Code	Allocated	Observed	Percent Completed
DF001	10.000	0.000	0.00
DM004	100.000	0.471	0.47
DO007	20.000	1.000	5.00
DV002	40.000	0.000	0.00
LD020	400.000	500.267	125.07
LD021	192.000	0.000	0.00
LK015	280.000	31.000	11.07
LK016	200.000	0.000	0.00
LK017	250.000	7.333	2.93
LK018	3200.000	978.000	30.56
LS023	264.000	0.000	0.00
LS024	72.000	0.000	0.00
LW013	300.000	50.767	16.92
LY002	48.000	12.000	25.00
Summary:	5376.000	1580.837	29.41

LWA Publications

82. **Fiore, W., Levin, L., McLaughlin, M. A., et al.**
2023, submitted
The Green Bank North Celestial Cap Survey. VIII. 21 New Pulsar Timing Solutions

81. **DiLullo, C., Reeve, W.D., Hicks, B.C., & Dowell, J.**
2023, PASP, 135, 044501
Scattering Parameter Measurements of the Long Wavelength Array Antenna and Front End Electronics.

80. **Krishnan, H., Beardsley, A., Bowman, J.D., Dowell, J., Kolopanis, M., Taylor, G.B., & Thyagarajan, N.**
2022, MNRAS, 520, 1928
Optimization and Commissioning of the EPIC Commensal Radio Transient Imager for the Long Wavelength Array

79. **Helmboldt, J.F., Clarke, T.E., & Kassim, N.E.**
2022, Radio Science, e2021RS007372
Remote Sensing of Mid-Latitude Ionospheric Magnetic Field Fluctuations Using Cosmic Radio Sources

78. **Kumar, P., White, S.M., Stovall, K., Dowell, J. & Taylor, G.B.**
2022, MNRAS, stac316
Pulsar Observations at Low Frequencies: Applications to Pulsar Timing and Solar Wind Models

77. **DiLullo, C., Taylor, G.B., & Dowell, J.**
2021, JAI, 10, 2150015
Improvements to the Search for Cosmic Dawn Using the Long Wavelength Array

76. **Varghese, S.S., Dowell, J., Obenberger, K.S., Taylor, G.B., & Malins, J.**
2021, JGR Space Physics, e2021JA029296
Broadband Imaging to Study the Spectral Distribution of Meteor Radio Afterglows

75. **Obenberger, K.S., Dowell, J., Fallen, C.T., Holmes, J.M., Taylor, & G.B., Varghese, S.S.**
2020, Radio Science, 56, 7169
Using Broadband Radio Noise from Power-Lines to Map and Track Dense Es Structures

74. **Dike, V., Taylor, G.B., Dowell, J., & Stovall, K.**
2020, MNRAS, 496, 3623
Detecting Pulsar Polarization below 100 MHz with the Long Wavelength Array

73. **Gerekos, C., Bruzzone, L., & Imai, M.**
2020, IEEE Trans. Geosci. Remmote Sens, vol 58, No. 4, p. 2250
A Coherent Method for Simulating Active and Passive Radar Sounding of the Jovian Icy Moons

72. **Obenberger, K.S., Holmes, J.M., Ard, S.G., Dowell, J., Shuman, N.S., Taylor, G.B., Varghese, S.S., & Viggiano, A.A.**
2020, JGR, 125, 9
Association between Meteor Radio Afterglows and Optical Persistent Trains

VLA 50-86 MHz

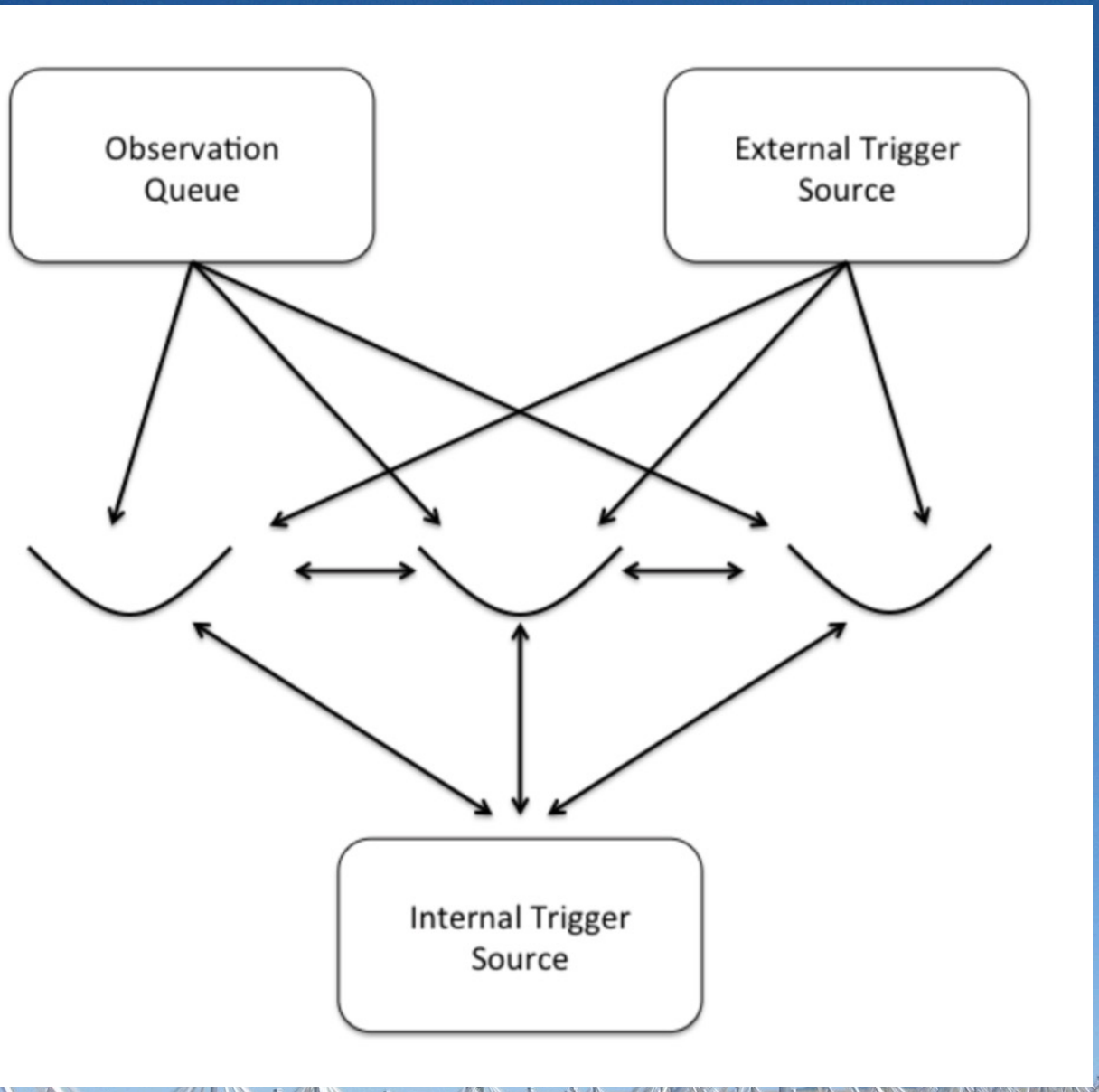
New 4 band feeds (MJP)
4 meter band: 50-86 MHz
All 28 installed

NRAO announced Shared Risk Observing starting for August 2, 2021 proposal Deadline

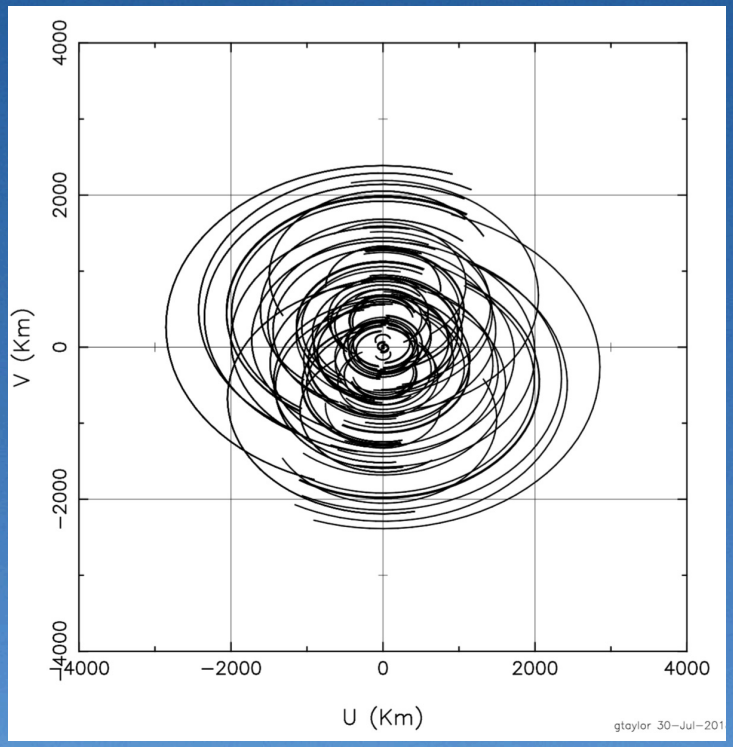
Some nagging issues with self-generated RFI

LWA Swarm Concept

Dowell
& Taylor
2018
JAI



LWA Swarm Concept



- Goal of 3 existing full stations (●) plus ~10 LWA mini stations (●), baselines up to 2500 km for resolution 0.5” at 80 MHz with 5 mJy sensitivity
- Cost is ~$7M including 1 year of operations

LWA Swarm Membership

- University of New Mexico – Greg Taylor
- Texas Tech University – Tom Maccarone
- Arizona State University – Judd Bowman
- Embry-Riddle Aeronautical University – Andri Gretarsson
- University of Victoria – Ian Hoffman
- Hillsdale College – Tim Dolch

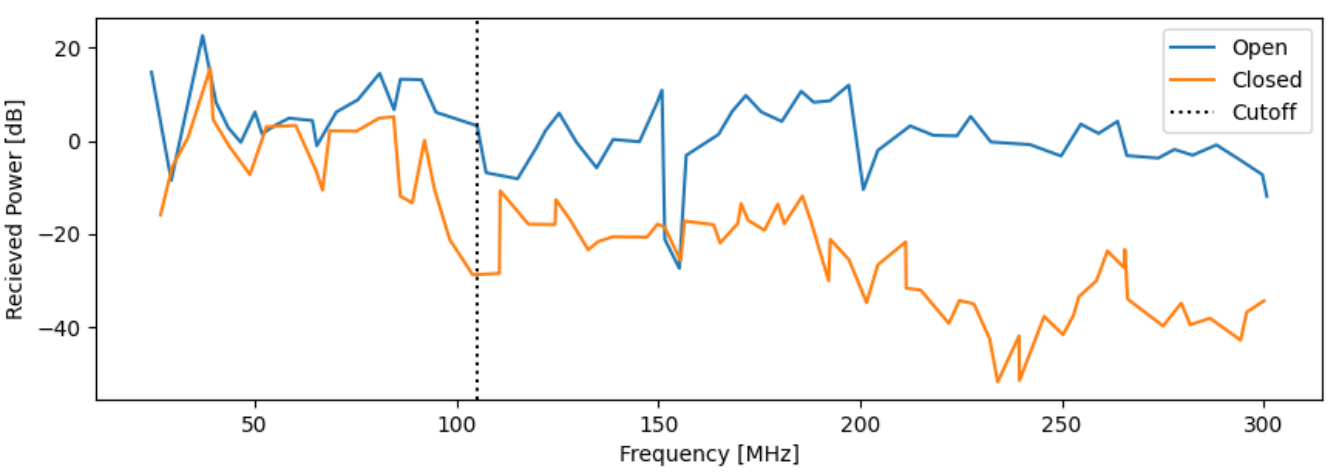
In discussions:

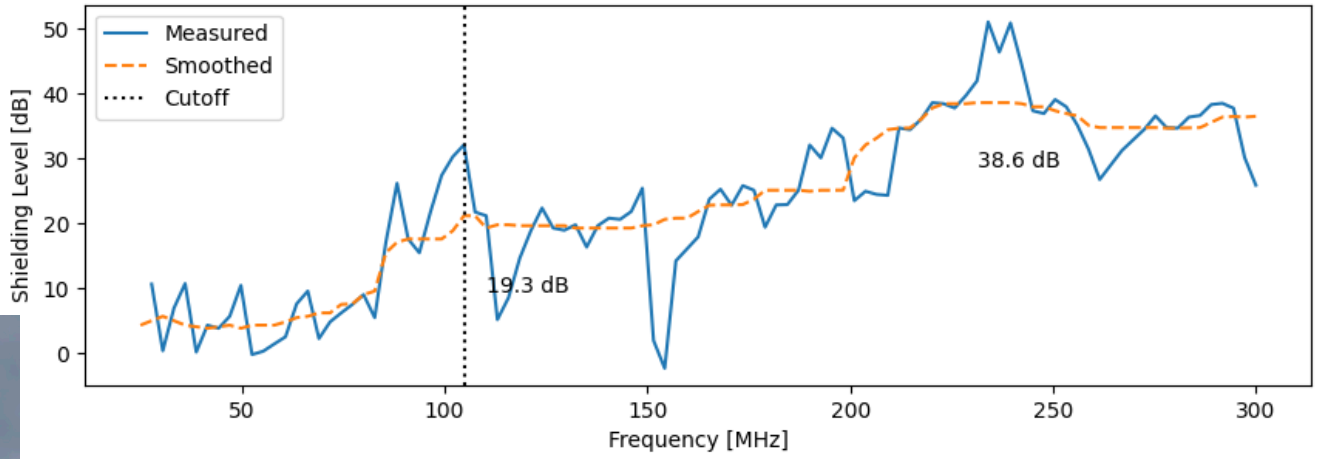
- UTRGV – Teviet Creighton
- Caltech – Gregg Hallinan
- Univ. of Colorado - Various

LWA-NA Construction

LWA-NA Construction

LWA-NA Construction


Recieved Power [dB]
Frequency [MHz]
Open
Closed
Cutoff


Shielding Level [dB]
Frequency [MHz]
Measured
Smoothed
Cutoff
19.3 dB
38.6 dB

LWA-NA Construction

Summary

- LWA has demonstrated technical feasibility and scientific results (>80 refereed publications to date!)
- Lots of exciting science at low frequencies. Progress requires:
  - High temporal, spectral, and spatial resolution
  - Sensitivity

  ➔ eLWA and **LWA Swarm**
- Current experiments are providing new hardware and software, and a better understanding of the sky at long wavelengths
- LWA capability continues to increase (including OVRO-LWA)
- NRAO has agreed to shared risk ELWA proposals

LWA Swarm Concept

- Develop new scientific capability in the US
- Provide educational opportunities in STEM (including 3 MSI Universities)
- Build on success of LWA with low risk investment
- White paper submitted to 2020 Decadal Survey

The Swarm Development Concept for the LWA

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