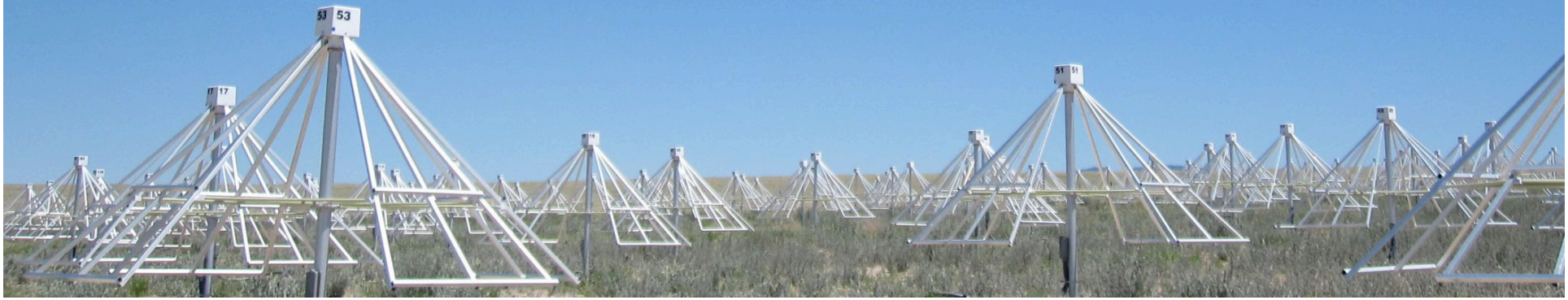
The Long Wavelength Array: A Dynamic Observatory for Radio Astronomy Education

Jake Hartman (JPL)
on behalf of the LWA collaboration



- Status of the Long Wavelength Array
- Data available to students
- Current and planned use of LWA data in the classroom
- How can your class get involved?

The first LWA station (LWA1)

- 256 dual-pol antennas within 110 m diameter
- 10–88 MHz; > 4:1 sky:noise dominance for 25–87 MHz
- Complete and operating

The first LWA station (LWA1)

UNM

Virginia Tech 1872

Naval Research Laboratory Washington, DC

JPL
Jet Propulsion Laboratory
California Institute of Technology

NRAO

Los Alamos NATIONAL LABORATORY EST. 1943

Observing modes

- Phased-array
  - + Four simultaneous, independently steerable beams
  - + Two ~16 MHz BW tunings per beam; full Stokes
- Interferometer
  - + Simultaneous all-sky imaging
  - + 75 kHz BW; full Stokes

More details / shameless advertising

J2: Today at 14:00 & 14:20

Commissioning, Operations, and Early Results for the Long Wavelength Array
Joe Craig (UNM)

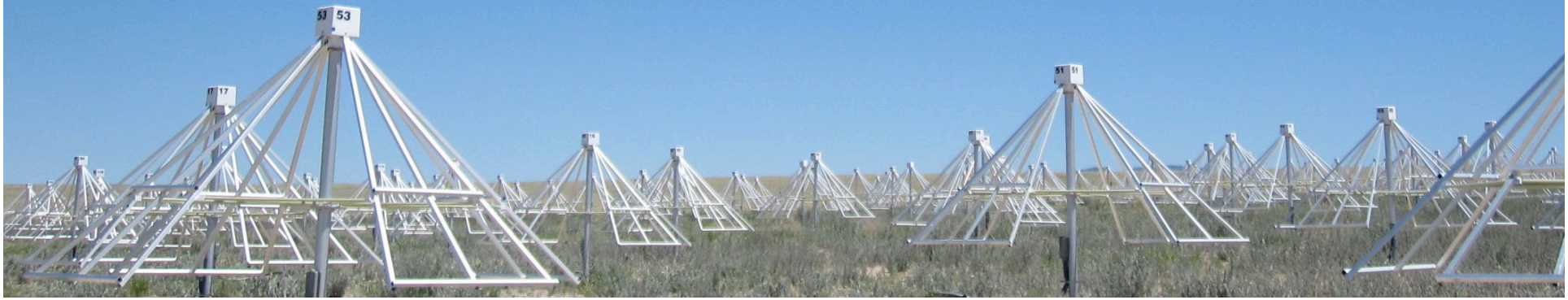
Results from LWA1 Commissioning: Sensitivity, Beam Characteristics, and Calibration
Steve Ellingson (VA Tech)

J4: Friday at 10:20 & 10:40

Observing Cosmic Dawn with the Long Wavelength Array
Jake Hartman (JPL)

Detecting the Universe beyond Redshift 20
Lincoln Greenhill (CfA)

Data available to student researchers



Allocated cycle 1 & 2 time

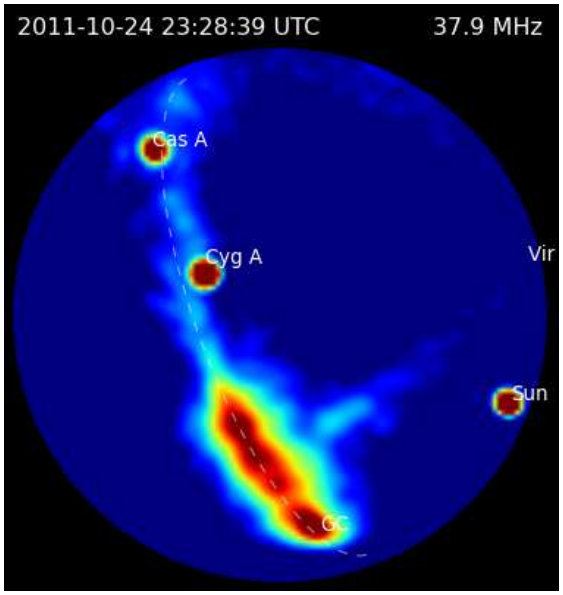
- An “open skies” instrument:
  - + Cycle 1 observations commencing now
  - + Cycle 2 proposals call will be soon
- Typical student projects will use ~6 beam hours each
- Cooperate with a “friend of the telescope”
- Use the Python-based LWA Software Library for analysis

- Project examples:
  measure fringes,
  detect the galactic plane,
  measure the spectral slope of galactic synchrotron emission,
  observe solar or Jovian bursts, …

LWA
Long Wavelength Array

Prototype all-sky imager (PASI)

- Correlator backend for the LWA1
- Receives a continuous 100 kSPS stream from all the dipoles
- Images the hemisphere many times per minute at 100% duty cycle and ≥ 90% uptime, covering ≈ 3 π sr every day
- This is a virtually unexplored region of transient phase space! (radio frequency, sky coverage, imaging cadence, uptime)



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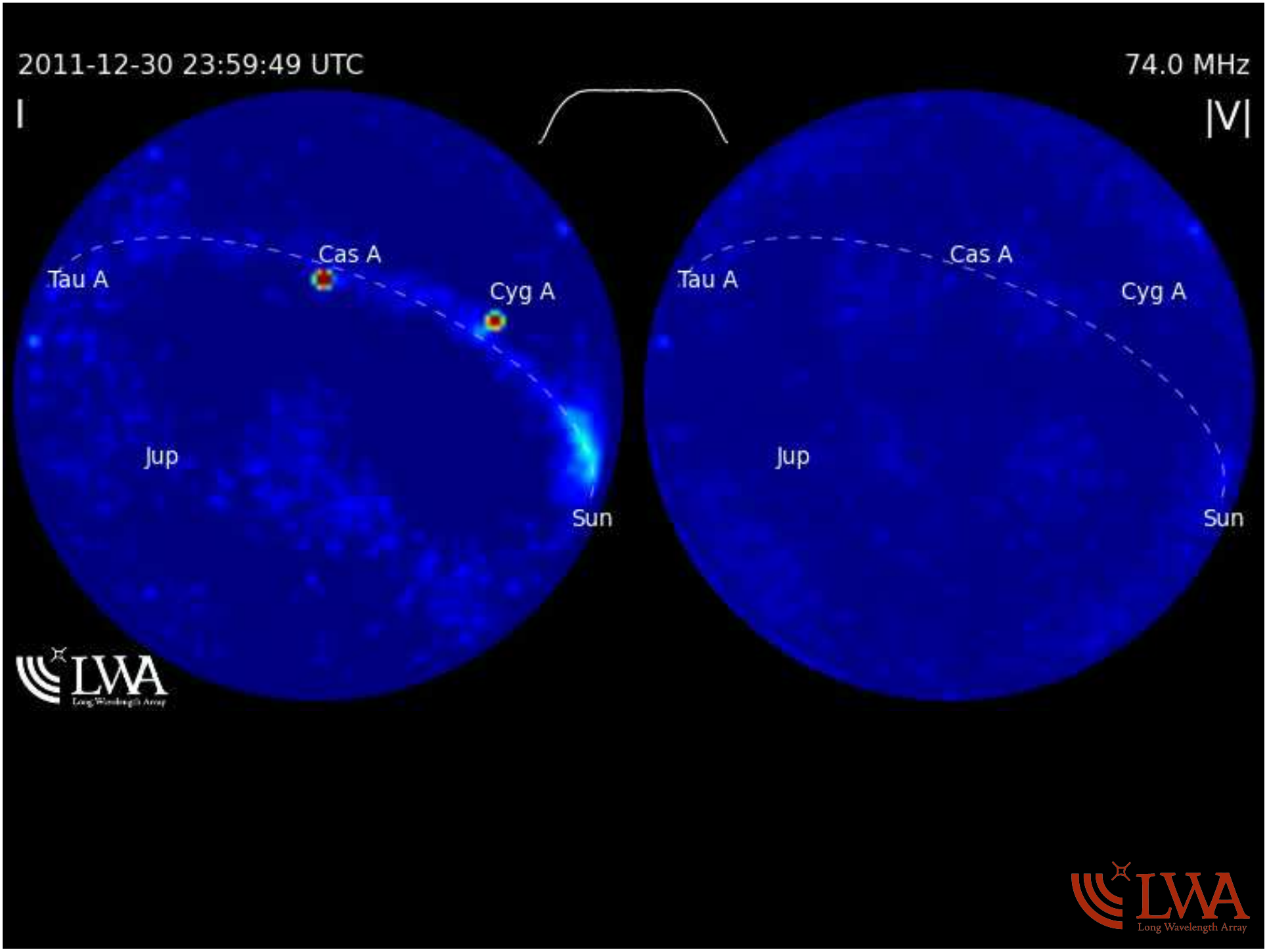
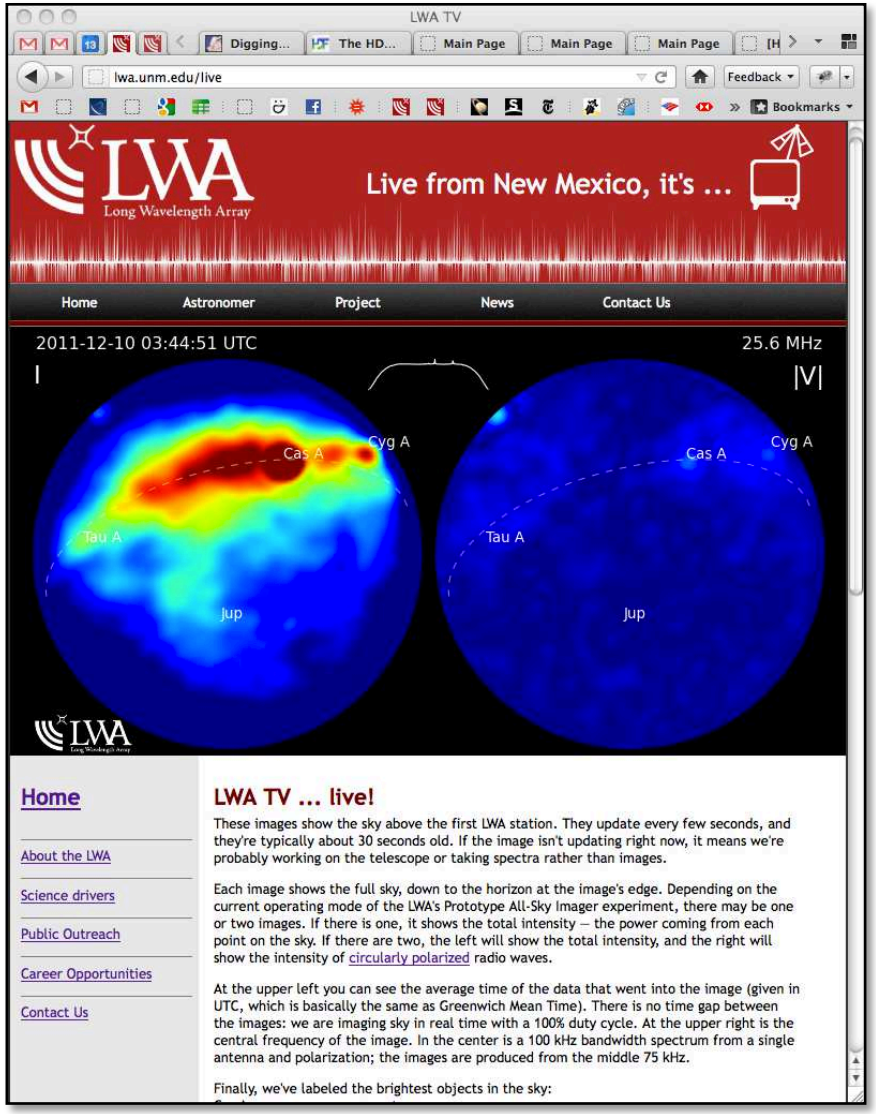
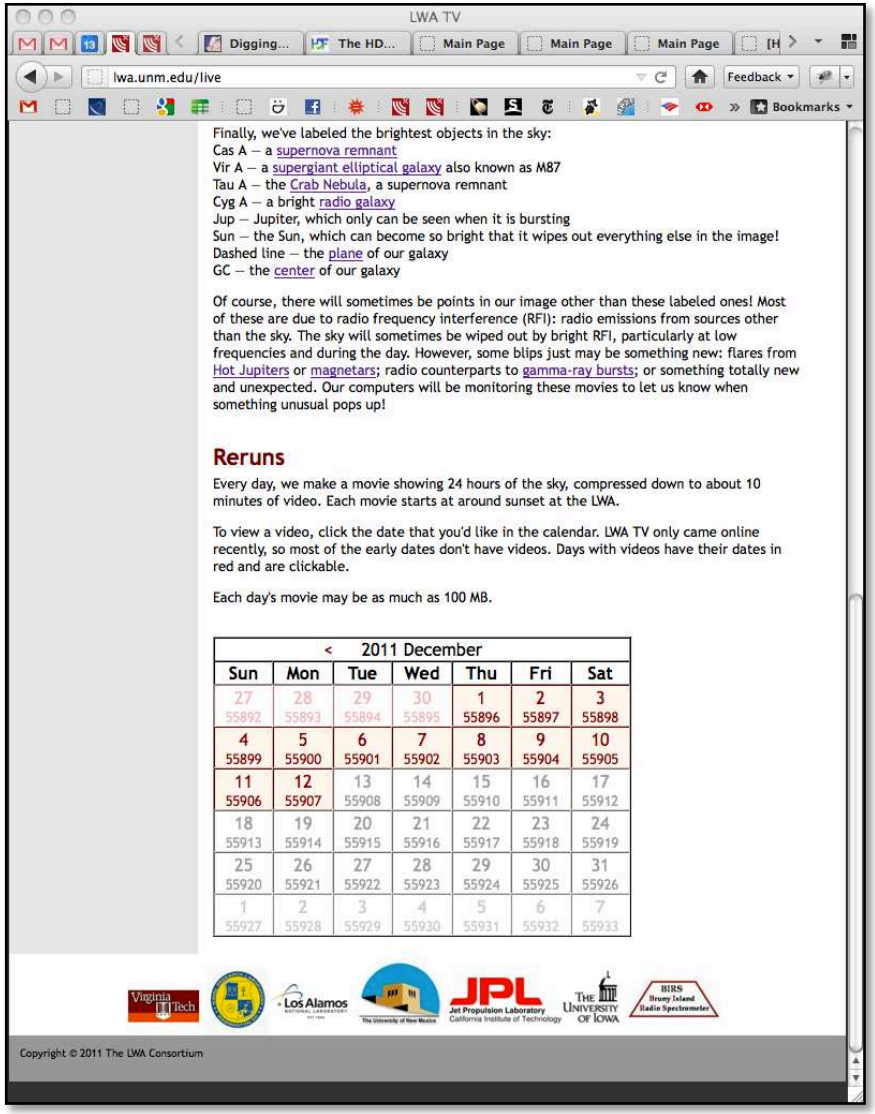

2011-12-30 23:59:49 UTC
74.0 MHz
I
|V|
Tau A
Cas A
Cyg A
Jup
Sun
Tau A
Cas A
Cyg A
Jup
Sun
LWA
Long Wavelength Array

http://lwa.unm.edu/live/





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LWA in the classroom

UNM Astro 101
Prof. Greg Taylor

LWA TV: an introduction to the dynamic sky, from long wavelength radio to TeV gamma rays

Live images get student attention!

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UNM Astro 423: Radio Astronomy
Prof. Greg Taylor

For advanced undergrads; offered every other spring

Students learn about radio telescopes, then …

- Write proposals
- Review and rank proposals; come up with a shortlist
- Schedule top-rated proposals
- Tour local telescopes (VLA & LWA)
- Reduce data, including homework on calibration and imaging
- Write up and present their results

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VT ECE 4984: senior “capstone” project

Prof. Steve Ellingson

Two-semester course for seniors, from concept through demonstration

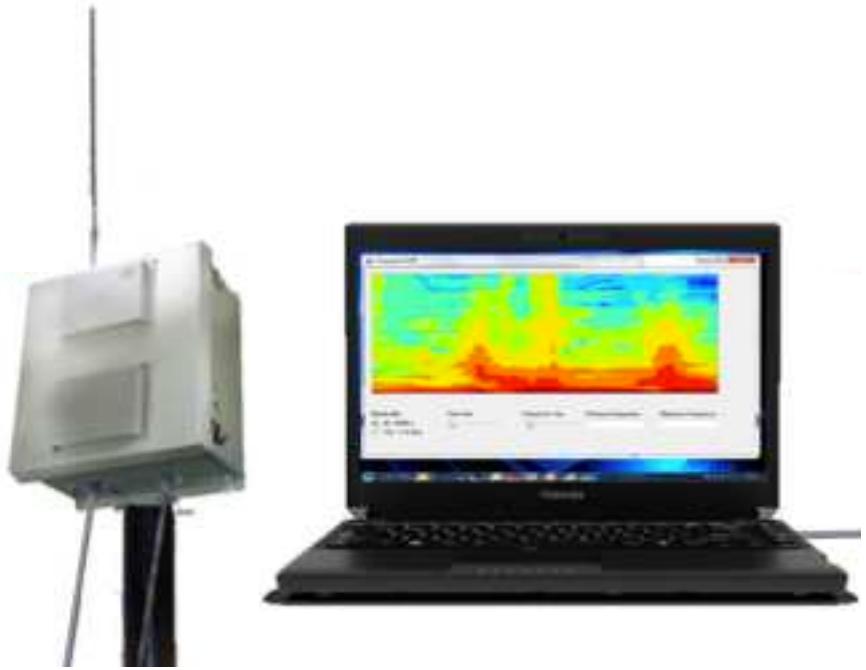
Fall: design, Spring: build

This year:

Radio Frequency Spectrum Sensor 25–80 MHz and 116–174 MHz

Next year:

Something more LWA-specific, since URO funding was awarded



RuFuSS

LWA Long Wavelength Array

UT Brownsville's LoFASM project
Prof. Rick Jenet

- Low-Frequency All-Sky Monitor project (DoD funded)
- Uses LWA antennas: great for student construction!
- Arecibo Remote Command Center scholars will carry out construction and observation

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Long Wavelength Array

Synthesis Imaging Summer School

- Offered every other summer in Socorro, NM (May 29 – June 15, 2012)
- 150 participant limit
- Lectures on low-frequency and large-*N* observing
- Data reduction workshops using canned LWA1 data

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YOUR institution!

- Flexible — anywhere from Astro 101 to advanced work
- LWA provides a few hours of data, if needed, to US university
- Requirements if observations are required:
  - Must be an integral part of the course (≥ 4 hours of class time)
  - A sample student report must be sent to the LWA collaboration
  - Cannot conflict with accepted observing programs
- Please contact us about details if you're interested!

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