PASEO Meeting

July 15-16, 2010 – Socorro, NM

The Radio Universe Project

Jim Condon

Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array

NRAO

The Radio Universe Project: A new NRAO effort to create spectacular images featuring radio data

- Primary goal: Produce visually striking and beautiful images featuring radio data that will inspire non-astronomers, even if they don't read the captions.
- Secondary goals: Promote the unique imaging capabilities of the EVLA, demonstrate the power of radio astronomy (e.g., the ability to see the "invisible universe"), or present scientifically exciting new results.
- Constraints: Several images should be ready in time for the formal dedication of the EVLA (Fall 2011) scientific commissioning, without compromising commissioning or early science.

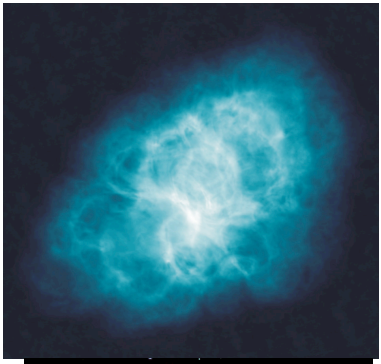
How should the NRAO balance broader impact and scientific research?

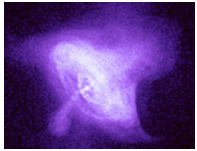
Most spectacular images have:

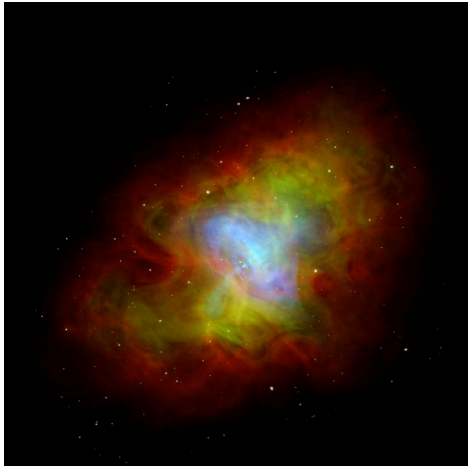
1) High spatial dynamic range: the images should show lots of detail, so the sources must subtend a large number of synthesized beams.
2) High intensity dynamic range: the images should have sufficiently high (> 100) signal-to-noise ratios that they don't look noisy to the eye.
3) Color: monochrome is dull; false colors should look "natural" and encode wavelengths, not intensities.
4) Multiple wavebands: EVLA data should be featured, but it is OK to layer infrared/optical/X-ray images to increase impact and be a reference for poeple not familiar with the appearance of radio sources.

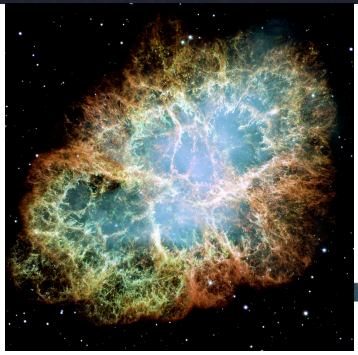
1) and 2) favor sources having the highest total flux densities = number of beam areas × flux per beam area (e.g., Cas A, Cyg A, …) observed in multiple configurations, especially the A configuration.

3) suggests scaled-array data at multiple wavelengths to yield radio continuum spectral indices, distinguish synchrotron from free-free emission, and add spectral lines.

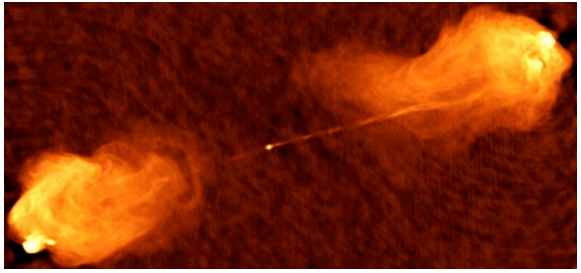








New optical data needed; e.g., for Cyg A



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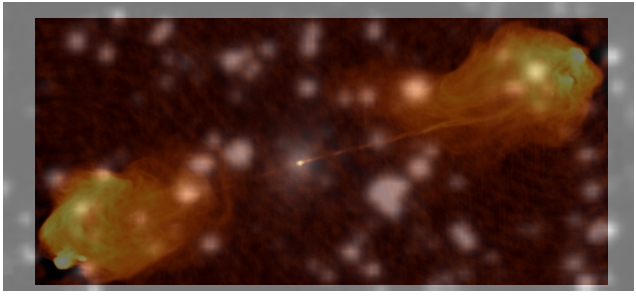

Preliminary Prioritized List of Images and Lead Observers

1) Crab Nebula = 3C 144, filled supernova remnant plus pulsar (Dale Frail)
2) Cyg A = 3C 405, large core-jet-lobe radio galaxy (Rick Perley)
3) IRC 10216, AGB star with concentric expanding spherical shells (Mark Claussen)
4) Vir A = 3C 274, nearby radio galaxy with a radio/optical jet (Frazer Owen)
5) M82 = NGC 3034, edge-on starburst galaxy (Josh Marvil)
6) M51 = NGC 5194/5, face-on starburst galaxy pair (Juergen Ott)
7) NGC 253, starburst galaxy (Juergen Ott)
8) Cas A = 3C 461, shell supernova remnant (Rick Perley)
9) W50 + SS 433, large "nautilus" supernova remnant with precessing central source (Miller Goss + James Miller-Jones)
10) Sag A, Galactic center complex (Juergen Ott)

Scheduling constraints:

- We need to complete the D-array observations before the reconfiguration to DnC and before the monsoon season ends high-frequency observations despite the current difficulties with referenced pointing (high frequencies again) by using commissioning time.
- We need to obtain and reduce A-array data in time for the formal EVLA dedication, without disrupting the EVLA configuration cycle. This implies that that the dedication will not occur until the scheduled reconfiguration to D in the fall of 2011. Additional advantages of that dedication time: better weather at the EVLA site, the compact array looks more impressive, and no Congressional campaigns will be underway in 2011.

Project Personnel

- NRAO EPO head John Stoke is the project leader and reports to Fred Lo
- Claire Chandler and Joan Wrobel assign observing time and schedule the observations
- Jim Condon is the astronomy/EPO liaison
- Imaging consultants include Zolt Levay (STScI) and Travis Rector (University of Alaska)

Conclusion: Questions for PASEO

- How should the NRAO balance broader impact and science?
- How might we improve the new Radio Universe Project? (suggestions for new sources, additional data to include in images, creative imaging techniques, …)


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