

WIDE FIELD RADIO TRANSIENT SURVEYS

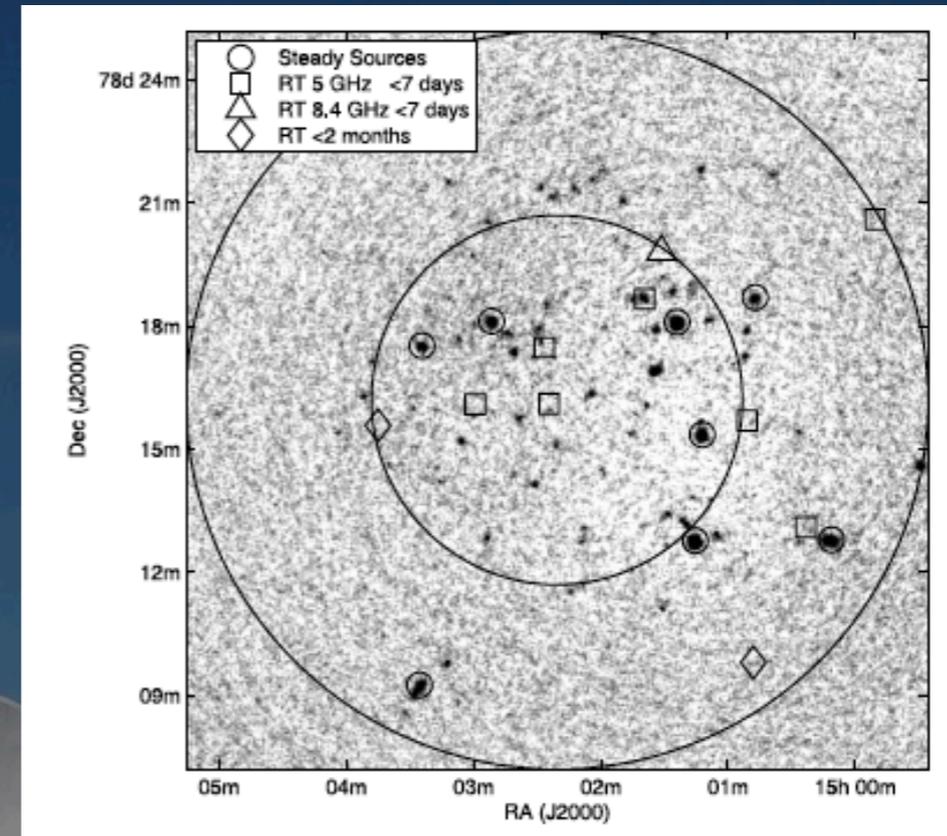
With the Allen Telescope Array

Steve Croft
UC Berkeley

working with Geoff Bower
and other collaborators at UC Berkeley Radio Astronomy Lab
and the SETI Institute

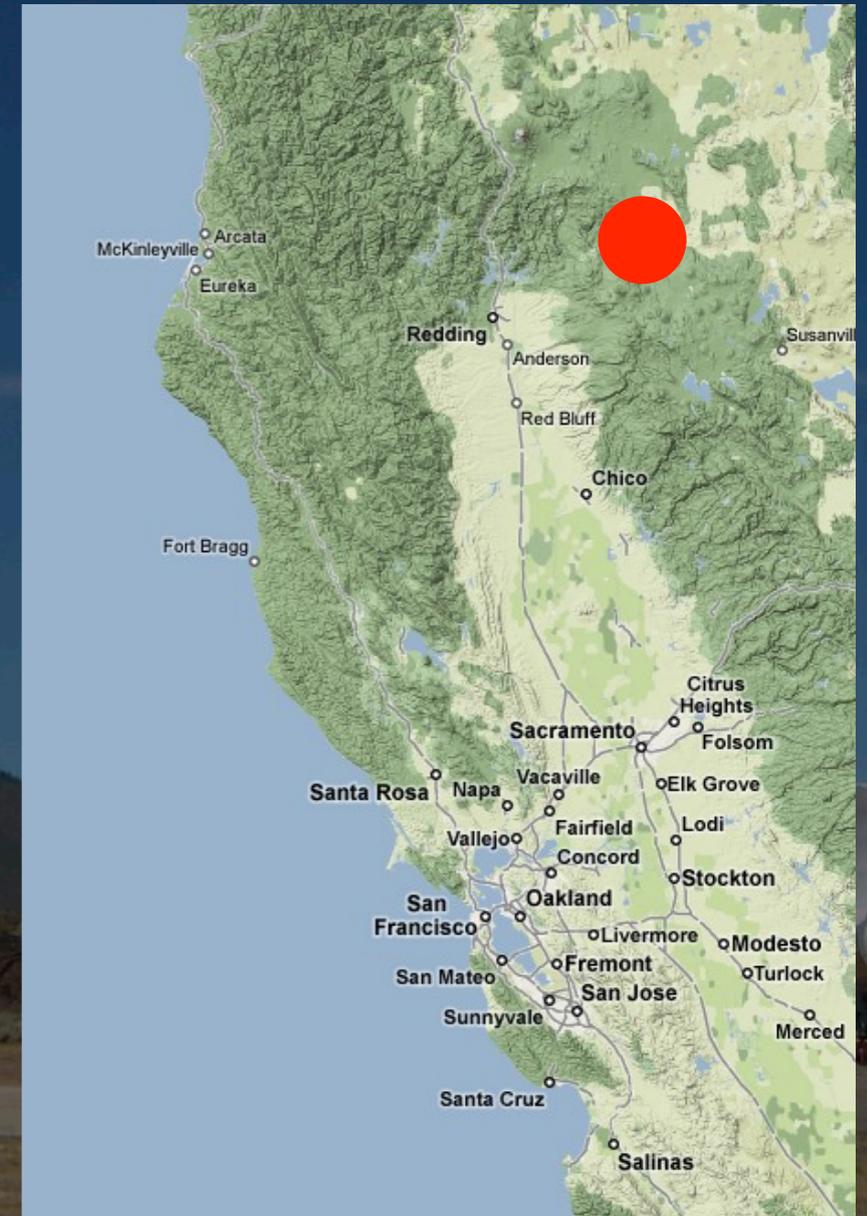
RADIO TRANSIENTS

- Bower et al. (2007), 944 epochs, 10 transients ≈ 2 mJy
- Matsumura et al. (2009), 9 transients > 1 Jy
- Transient progenitors - SNe, GRBs, OGRBAs, flares, etc.
- Time-varying sources - QSOs, tidal disruption, pulsars, RRATs, stars, etc.



ATA QUICK FACTS

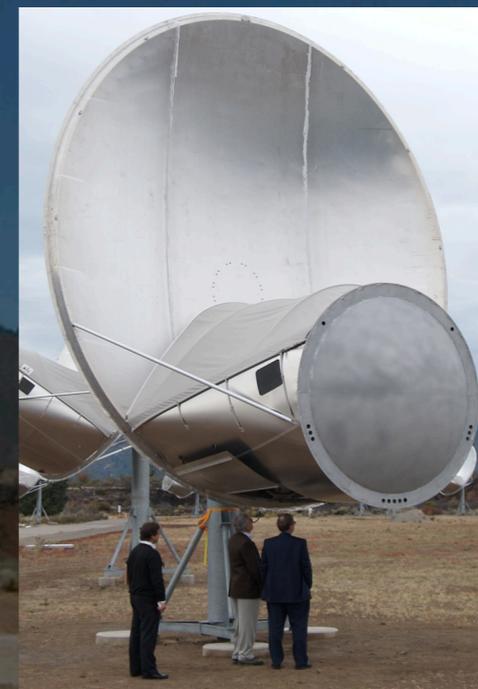
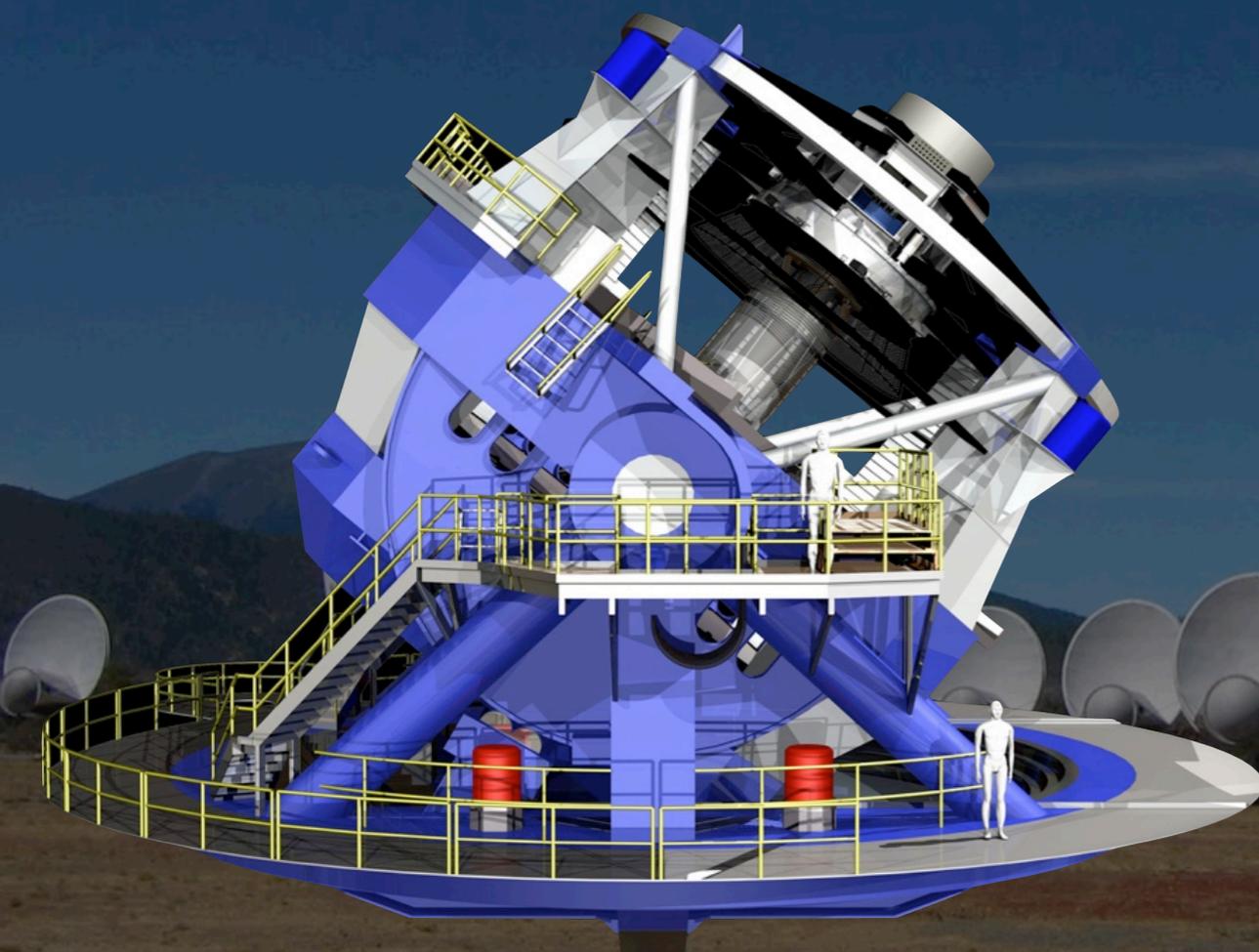
- Joint effort between RAL and SETI
- 42 6-m antennas
- Fast, for:
 - Surveys
 - Transients



Epoch	RAL Sci.	SETI Sci.	Eng.	SSA	EPO	Total
Sep 08 – Feb 09	1505	86	661	217	16	2485 hrs
Feb – Sep 09	1661	503	597	715	11	3487 hrs



FAST FOR SURVEYS



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WIDE FIELD OF VIEW

VLA

- Small dishes give wide FOV - 5 sq deg at 1.4 GHz
- High survey speed
- Beam FWHM 2' x 4' at 1.4 GHz



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ATA



WIDE FREQUENCY COVERAGE

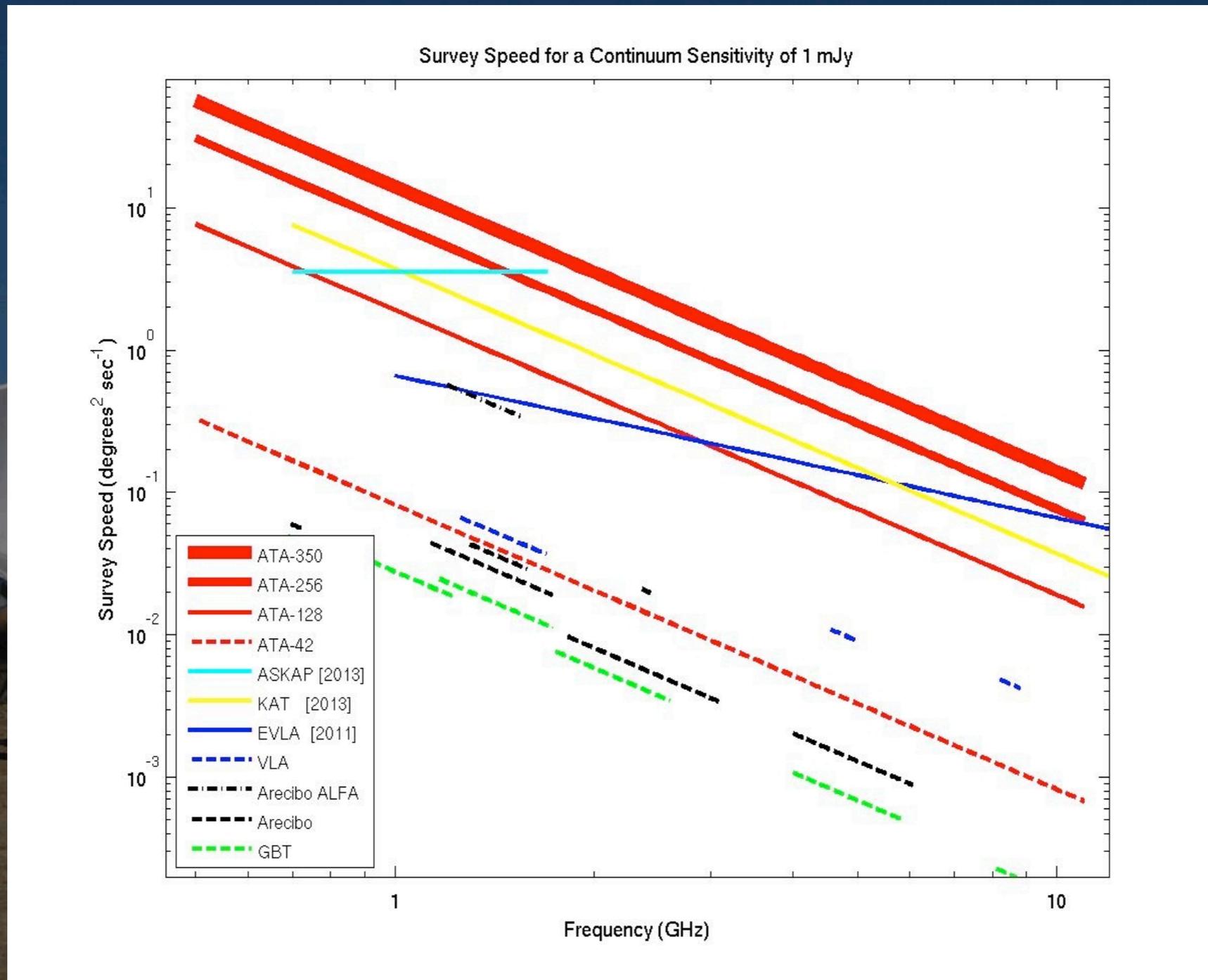
- 0.5 - 11.2 GHz with 100 MHz bandwidth
- Multiple back ends (currently 2 correlators and 3 beamformers) allow multiple tunings



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FAST FOR SURVEYS



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The Allen Telescope Array Twenty-centimeter Survey – A 690-Square-Degree, 12-Epoch Radio Dataset – I: Catalog and Long-Duration Transient Statistics

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ABSTRACT

The Allen Telescope Array (ATA) is a new radio telescope located at Hat Creek Radio Observatory in Northern California. It is designed to have a wide field of view (~ 5 square degrees at 1.4 GHz) and so can rapidly survey large areas of sky. This makes it an ideal instrument to search for transient and time-varying

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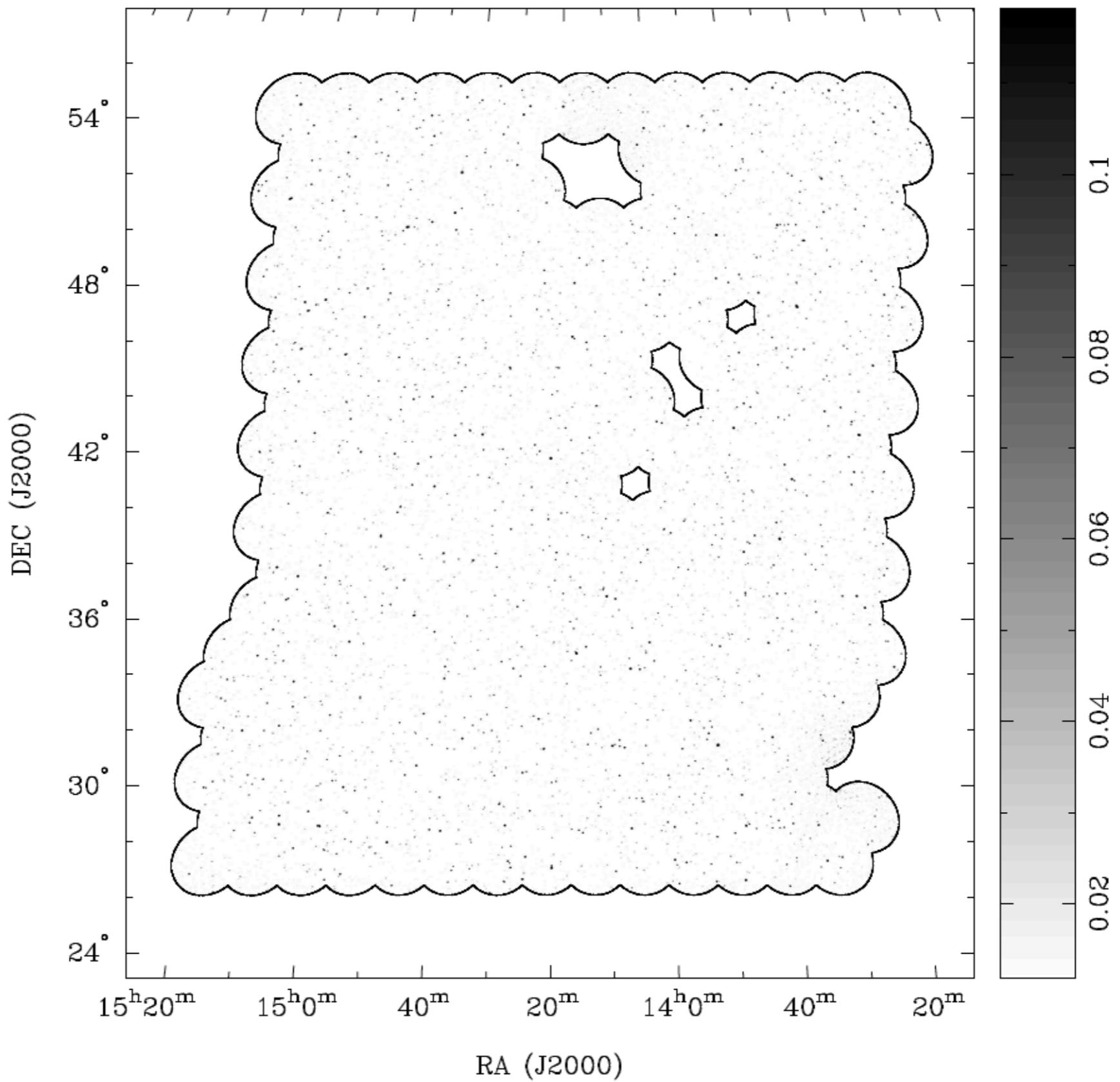
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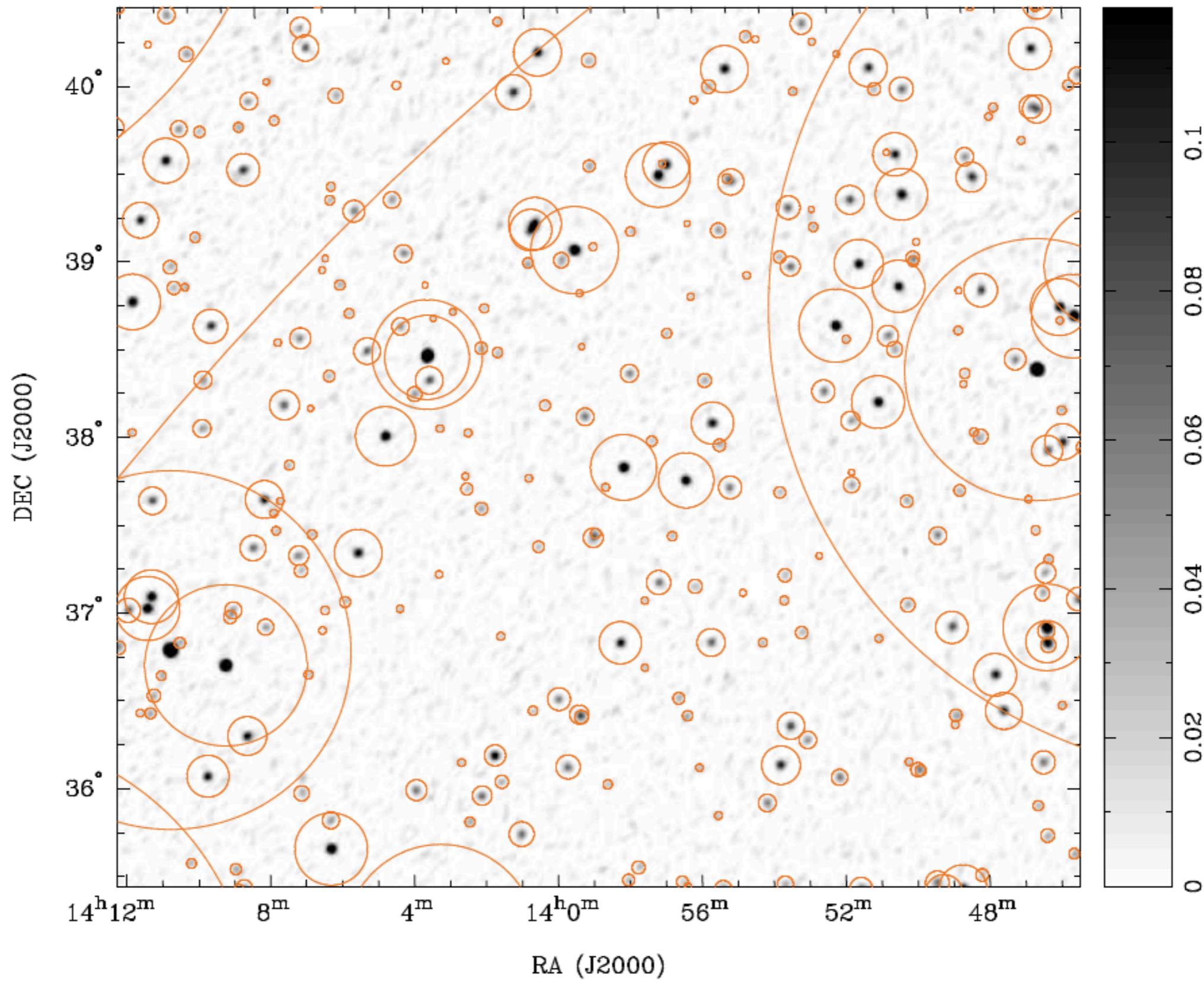
¹⁰California Institute of Technology, Department of Electrical Engineering, Pasadena, CA 91125, USA





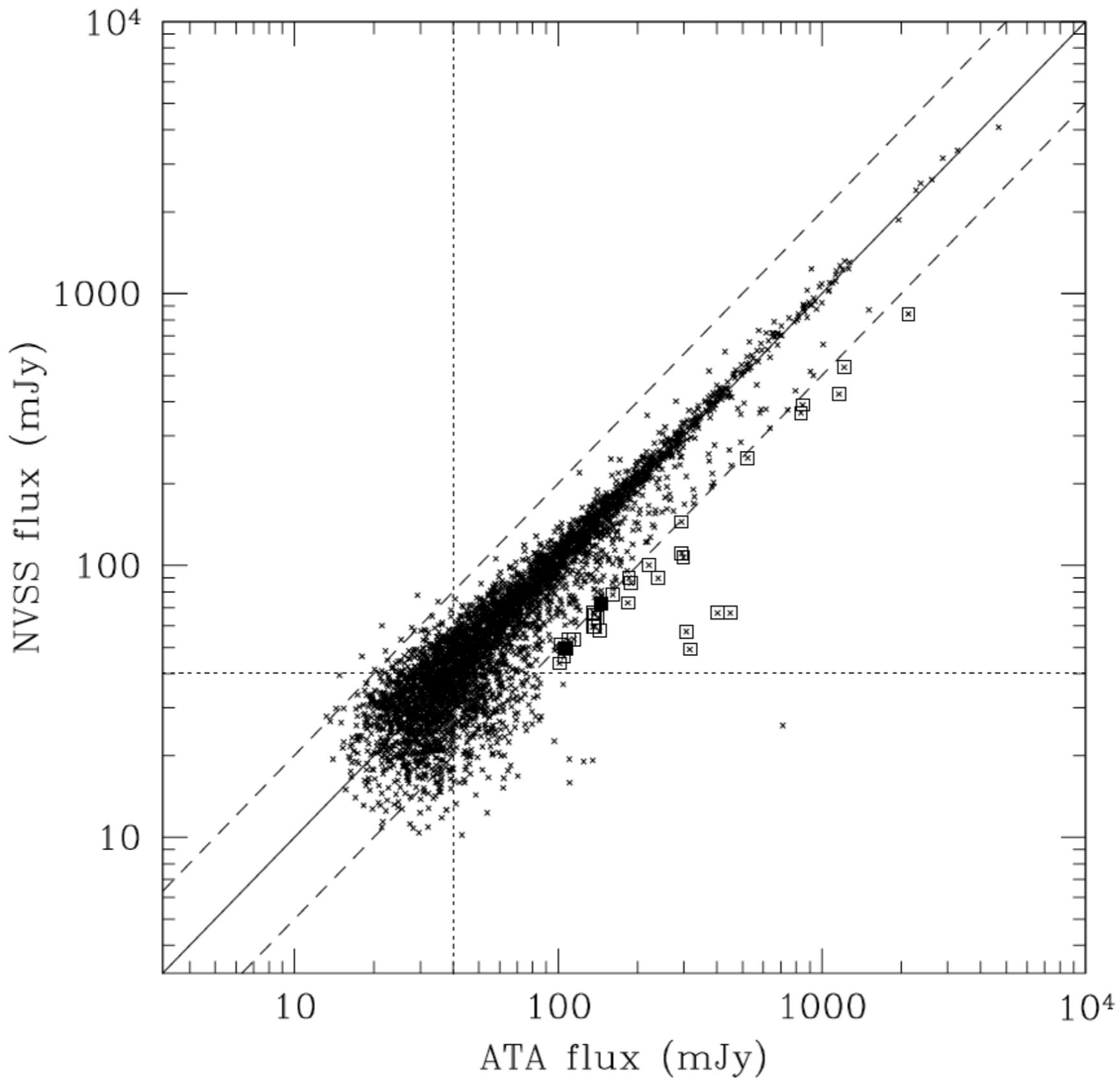
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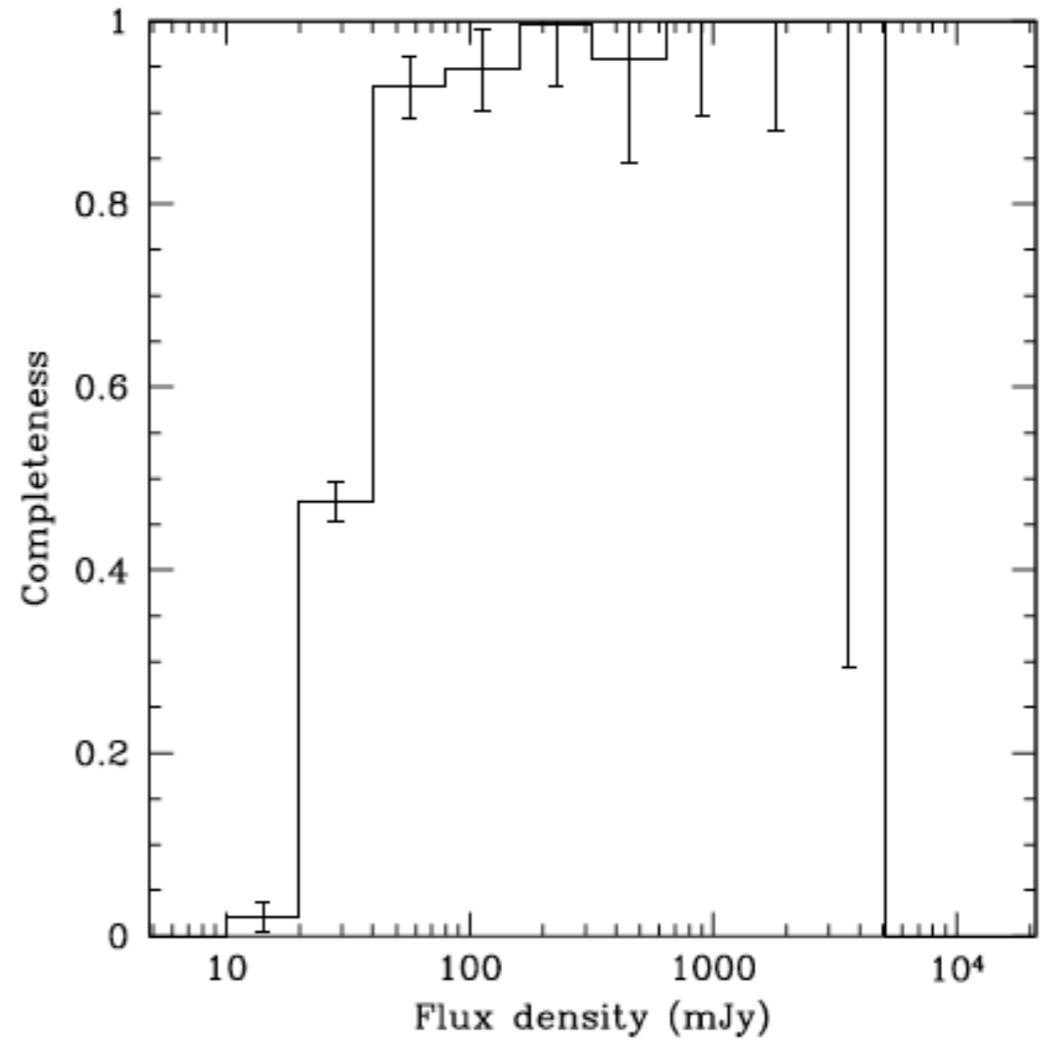
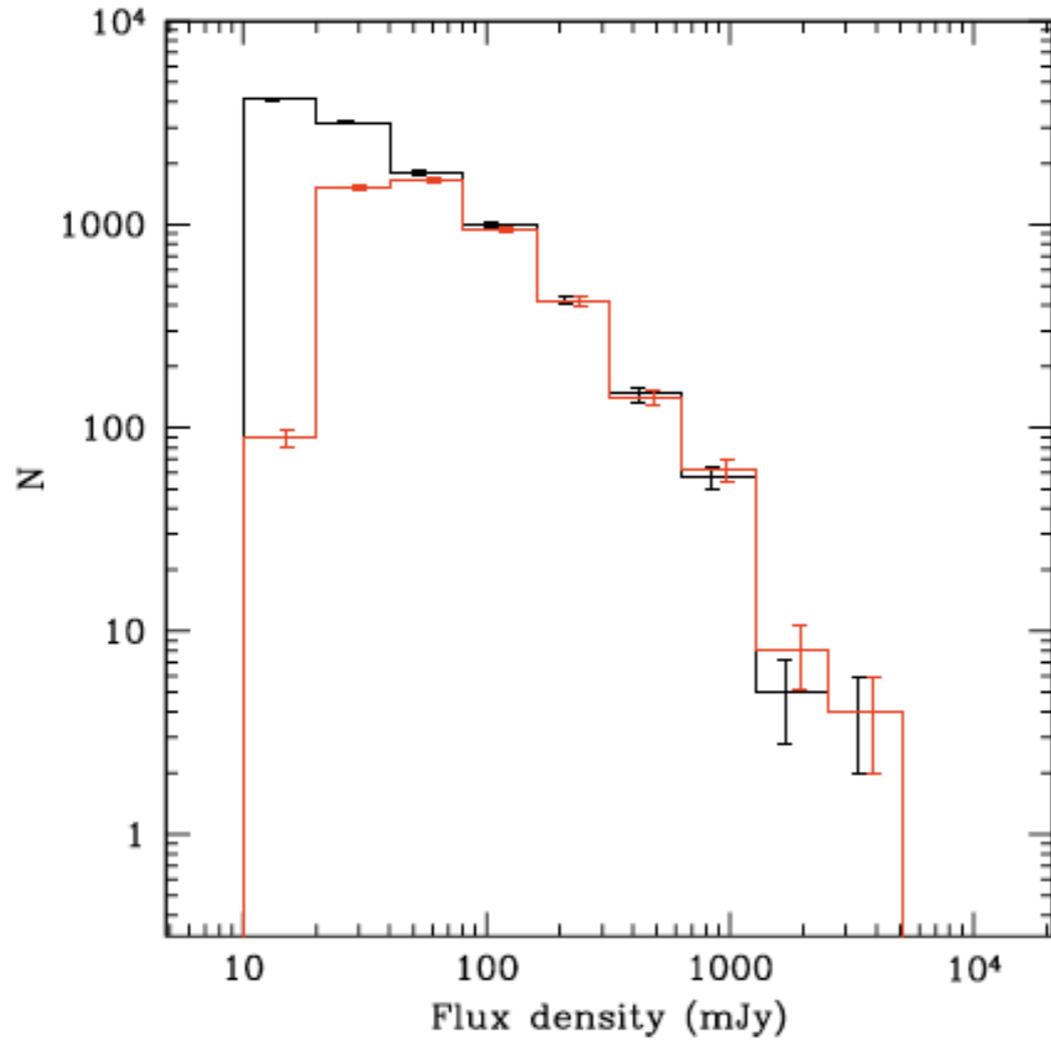
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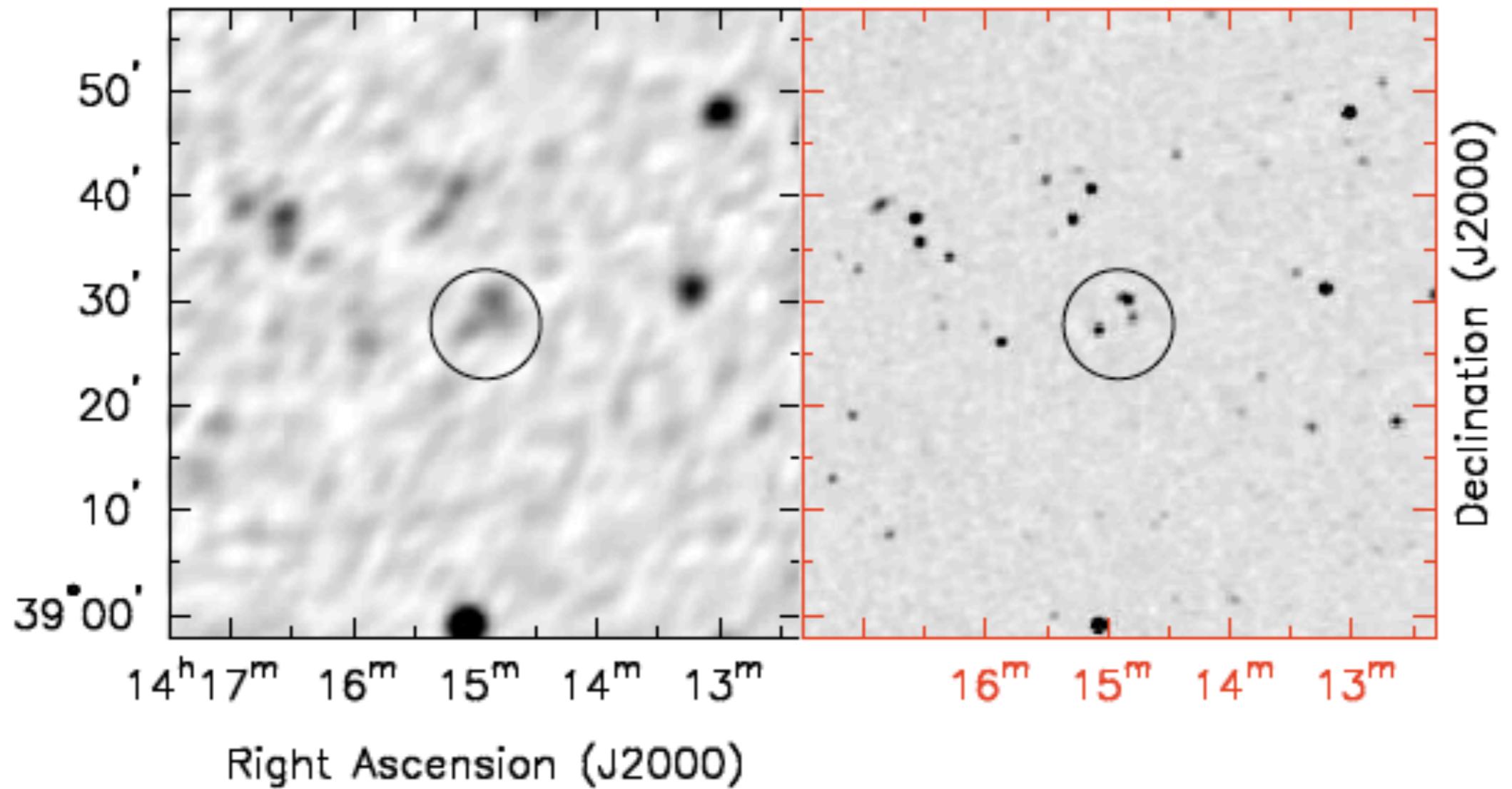
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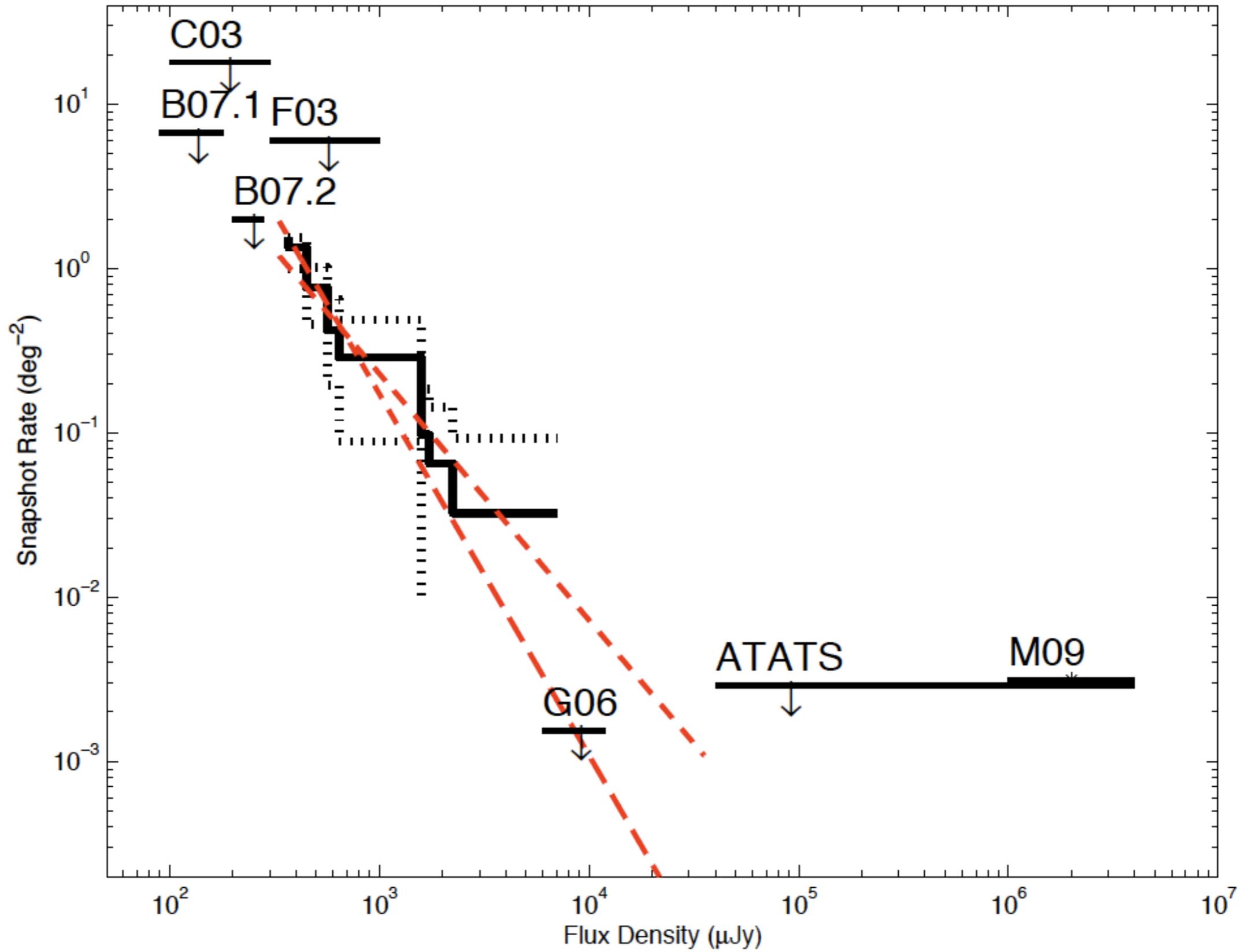
ATATS $f = 70.94$

NVSS $f = 0.00$



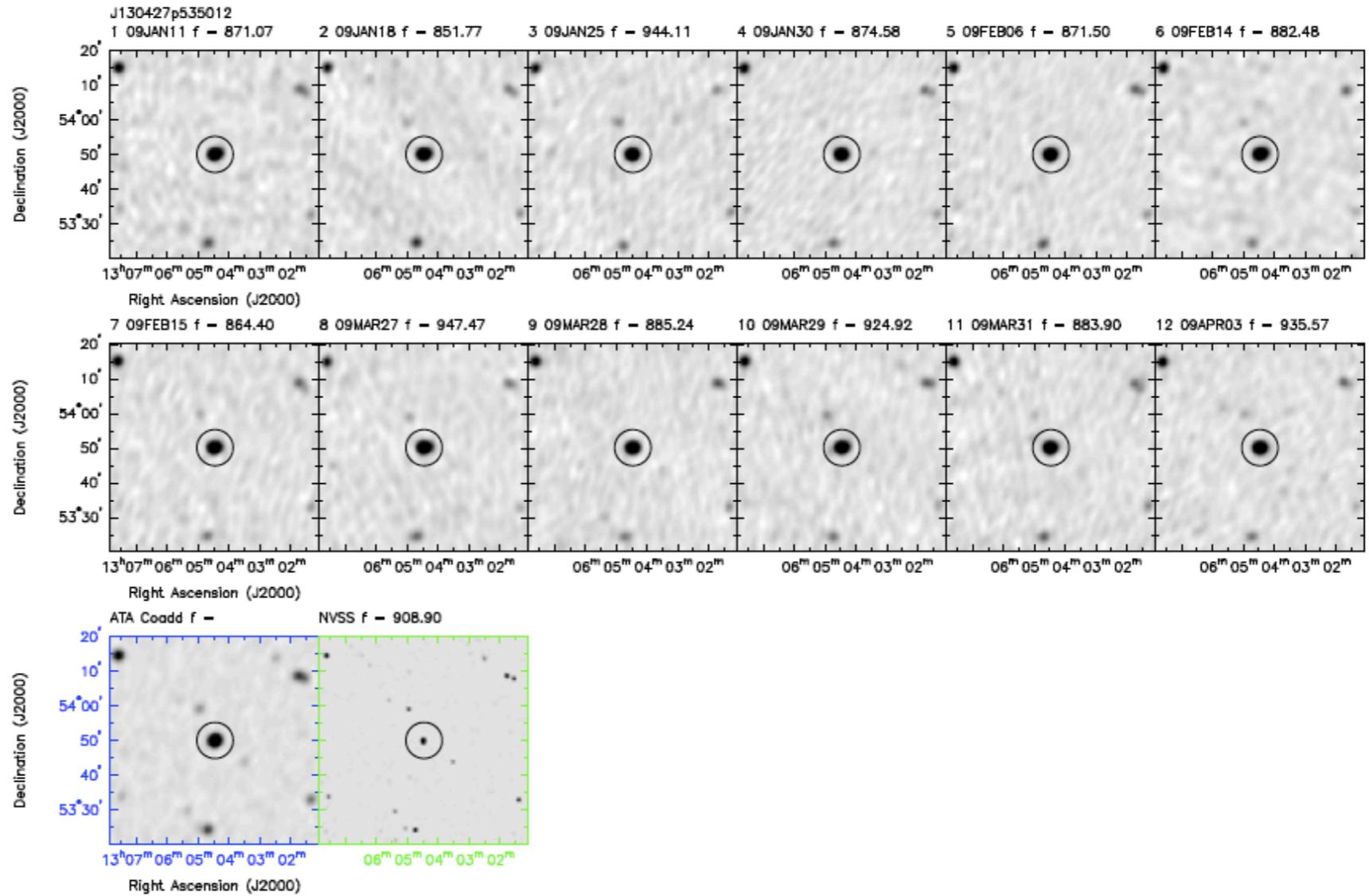
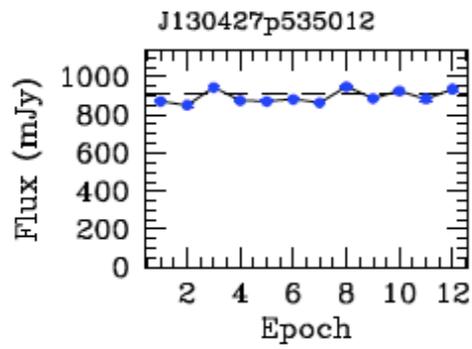
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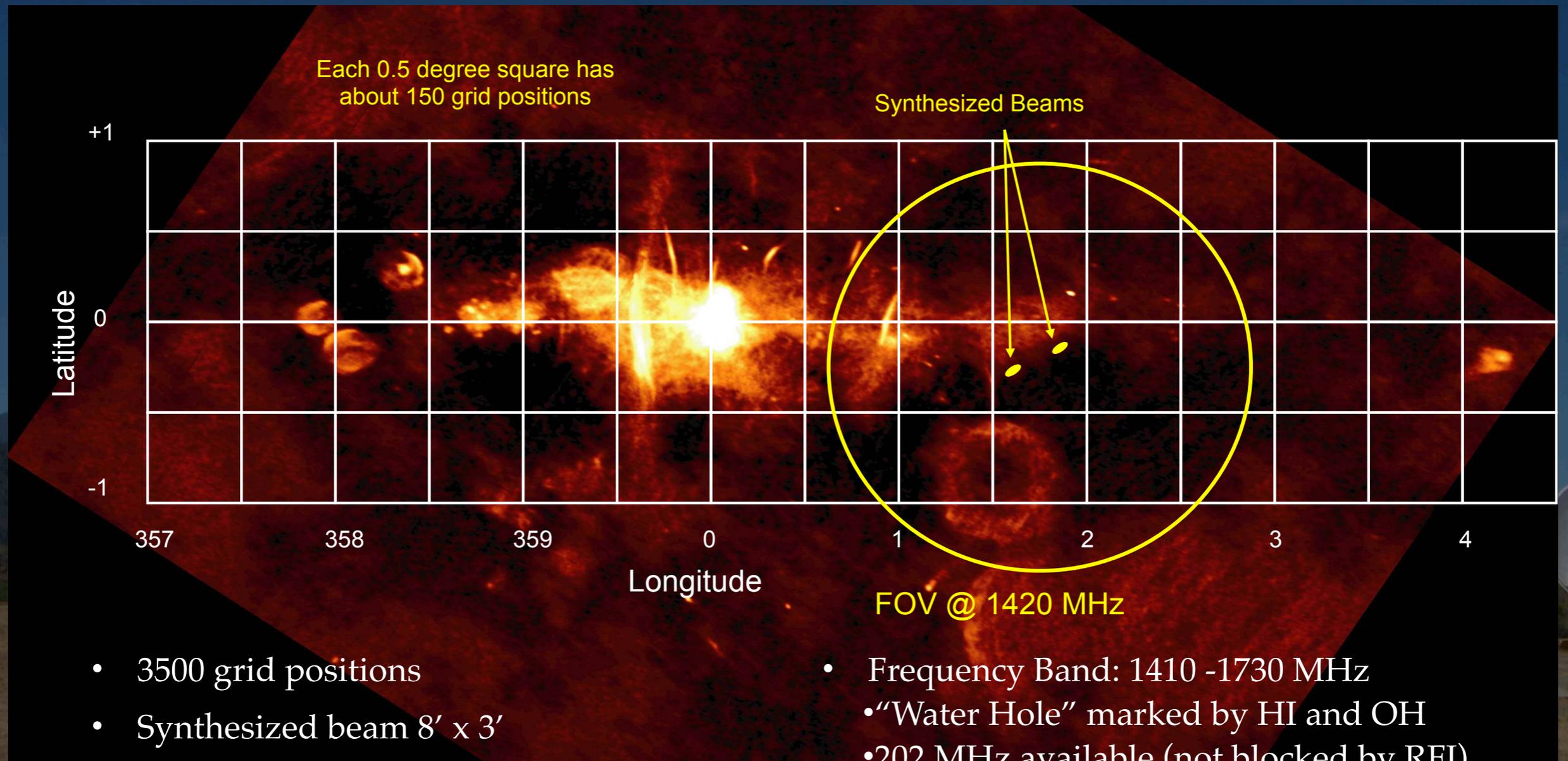




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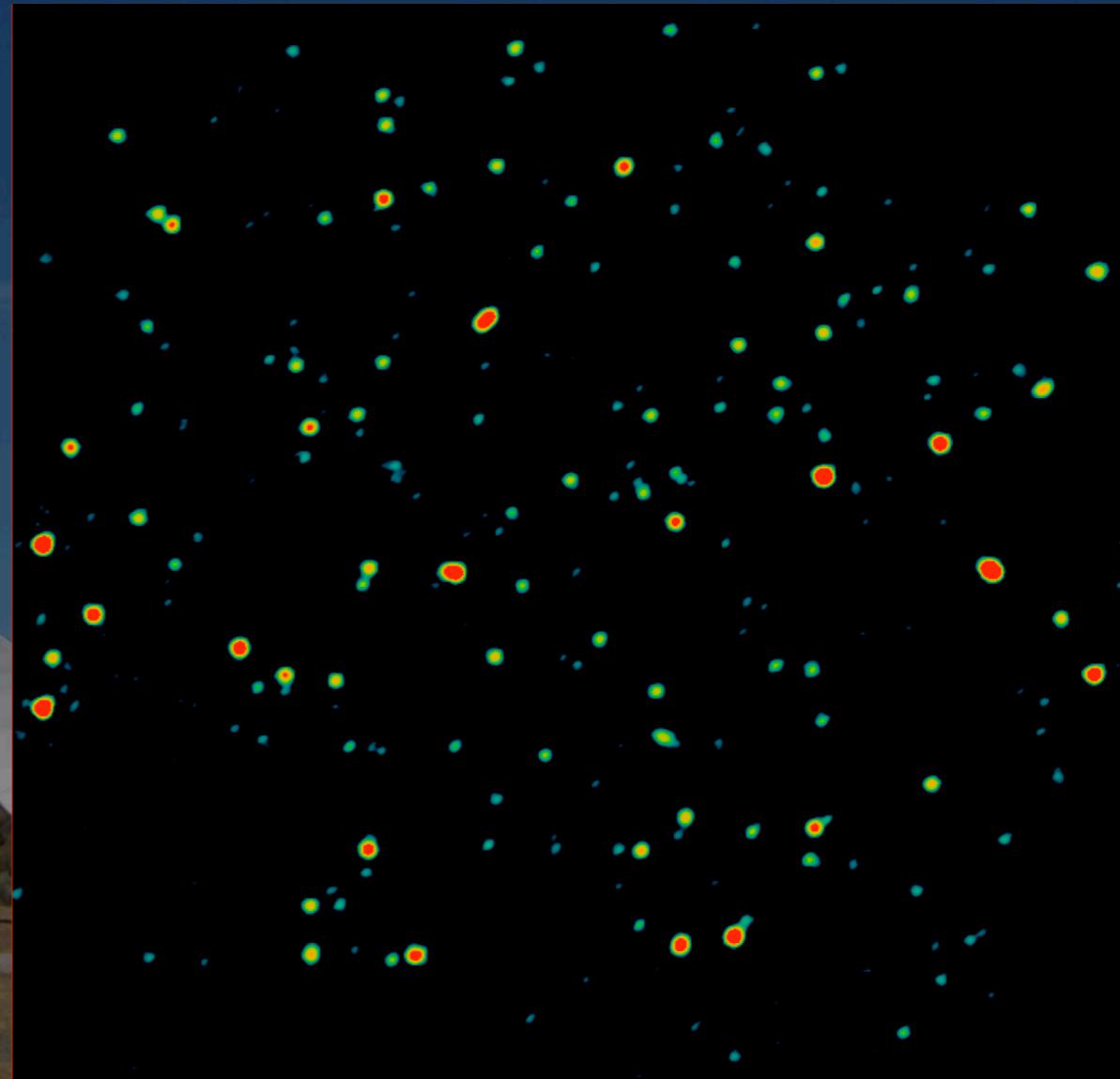


GALACTIC CENTER SURVEY

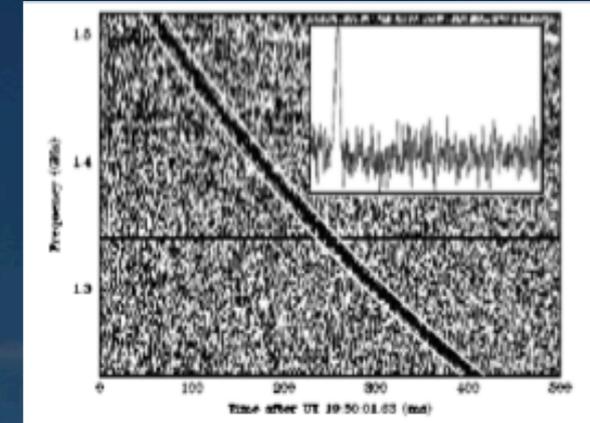
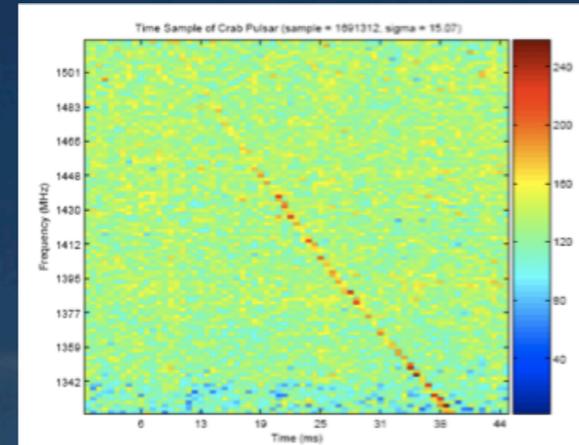
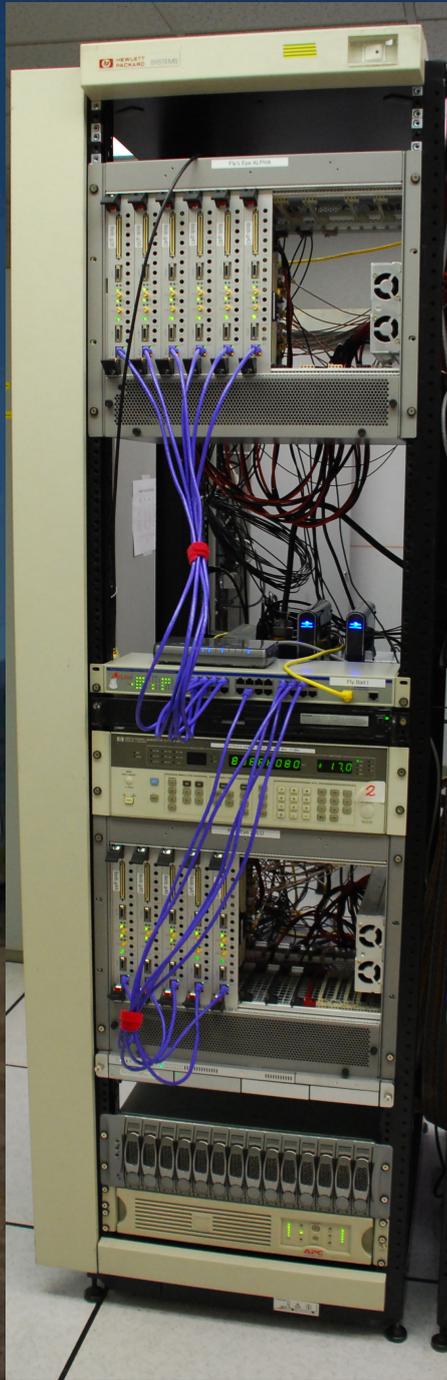


PIGSS

- 70 epochs of 10 sq degrees - 2 mJy rms
- Deep image from 15 epochs - 0.5 mJy rms
- Two epochs of 250 sq deg images - 2 mJy rms, 2 month separation
- 10^4 sq campaign launched
- Fluxes
- Variability
- Spectral indices



FLY'S EYE

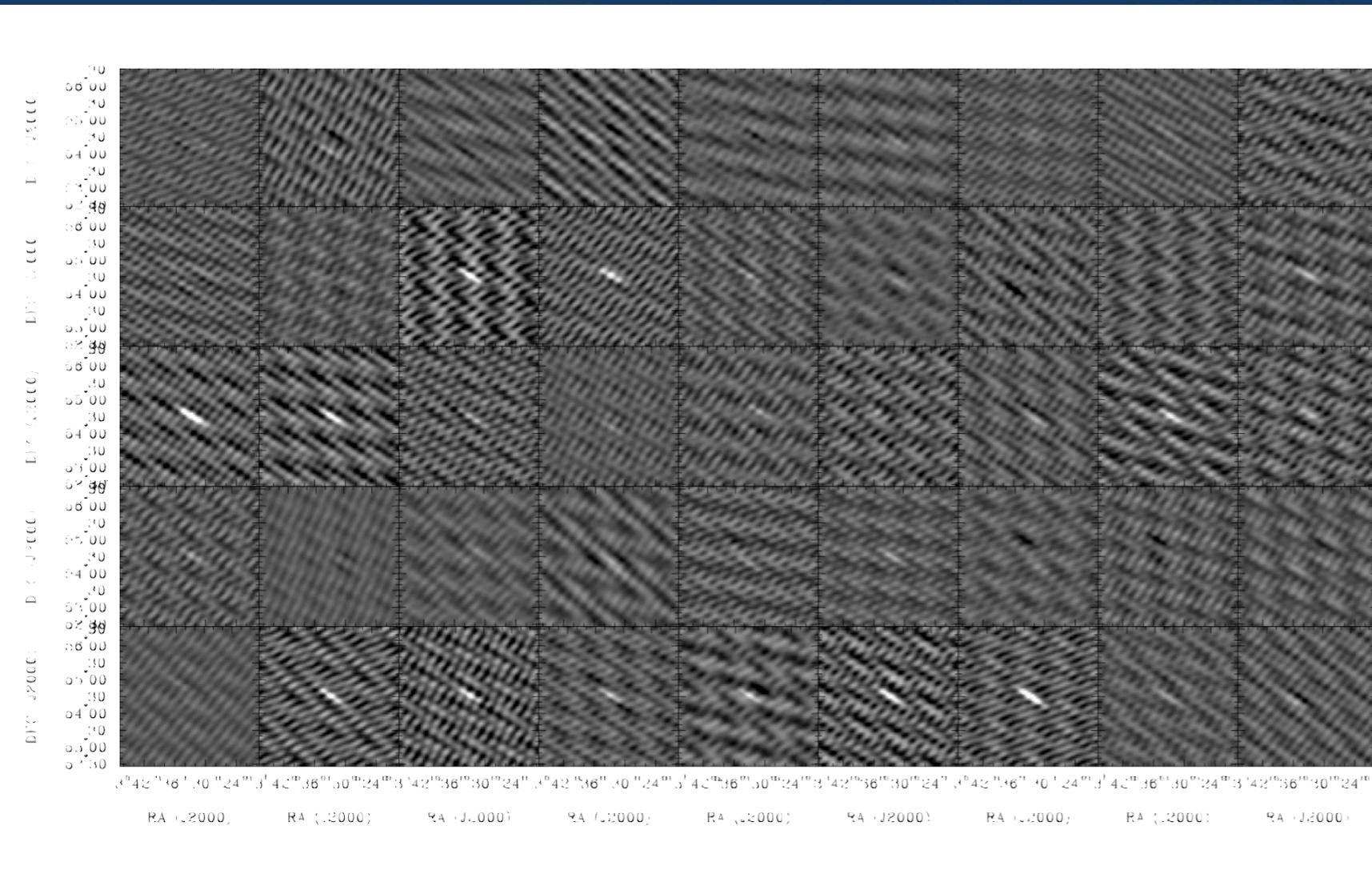


- Sensitive to rare, very bright (> 100 Jy) transients
- 200 sq deg FOV
- 600 hours of observing
- February, March and April 2008
- 13 TB of data
- 50,000 CPU-hour to process
- Analysis ongoing

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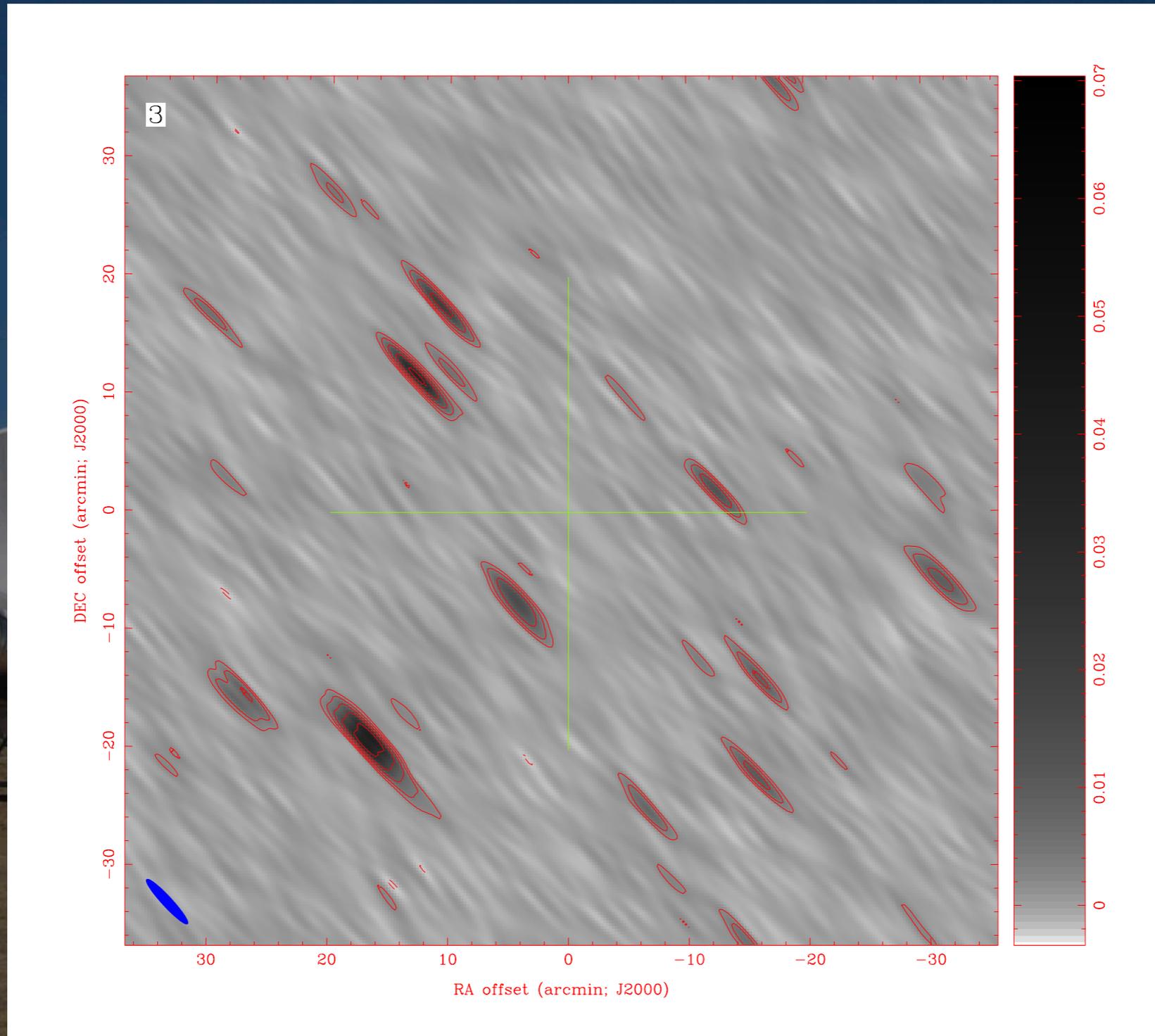
PULSAR IMAGING



- Pulsar B0329+54
- 100 ms dump time
- Each frame is during on pulse
- 6 antennas, limited bandwidth



TRIGGERED OBSERVATIONS



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ATEL #2472 - PTF10bzf



FUTURE GOALS

- Build out to 350 dishes
- SKA pathfinder



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Community Opportunities

Radio Sky Surveys Project

- Term-limited, community-driven surveys
- Public/Private Partnership in funding
 - \$26M ops + \$12M science / 8 years
 - \$40M construction
- Pitched to Astro 2010 Decadal Panel
- Build survey science community
- Develop large-N capability → SKA

Pre-RSSP

- Ongoing funded collaborations
 - Lightning on Mars
 - Polarimetry
- Funded science collaborations
- Development in...
 - Data management
 - Real time calibration, imaging
 - Large-N correlators & BF
 - Feeds & receivers

<http://astro.berkeley.edu/~gbower/RSS/RSSP.html>