

# *Using VLA Observations to Model LOFAR Skies*



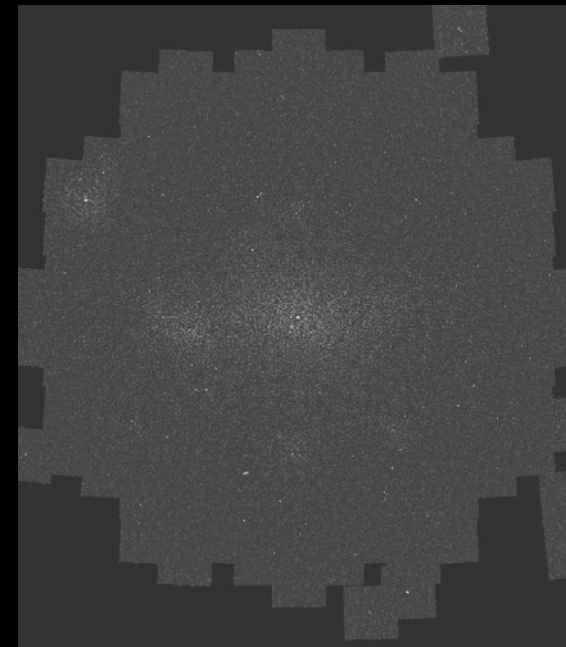
Philip F. Hopkins, MIT Summer REU 2003  
Advisors: Sheperd Doeleman & Colin Lonsdale

# *Introduction: The Problem*

- No good models/maps of the sky at LOFAR's low frequencies and high resolutions
  - Resolution  $\sim \lambda/d$ , and the longest LOFAR baselines will have  $d \sim 400$  km (compare the VLA, with  $d = 37$  km)
  - Need unresolved sources for calibration!



*Solution: Start at a Higher Frequency and Extrapolate Down*



VLA 328-MHz A-Array  
Observations

AIPs Imaging Tasks

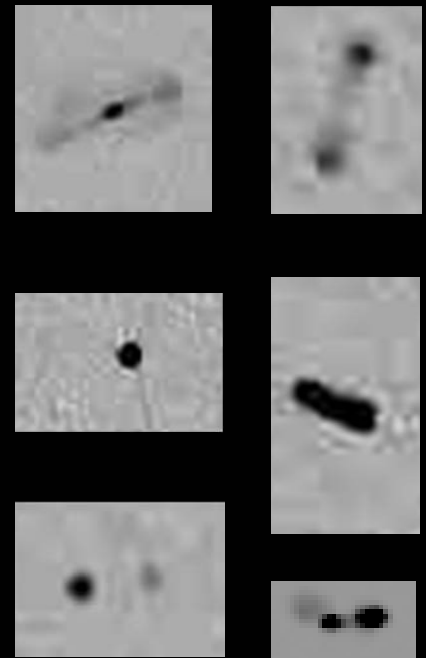
Wide-field Map Around  
3C249.1,  $\sim 3^\circ$  Diameter

# *The Basis of the Model – VLA Map at 328 MHz*



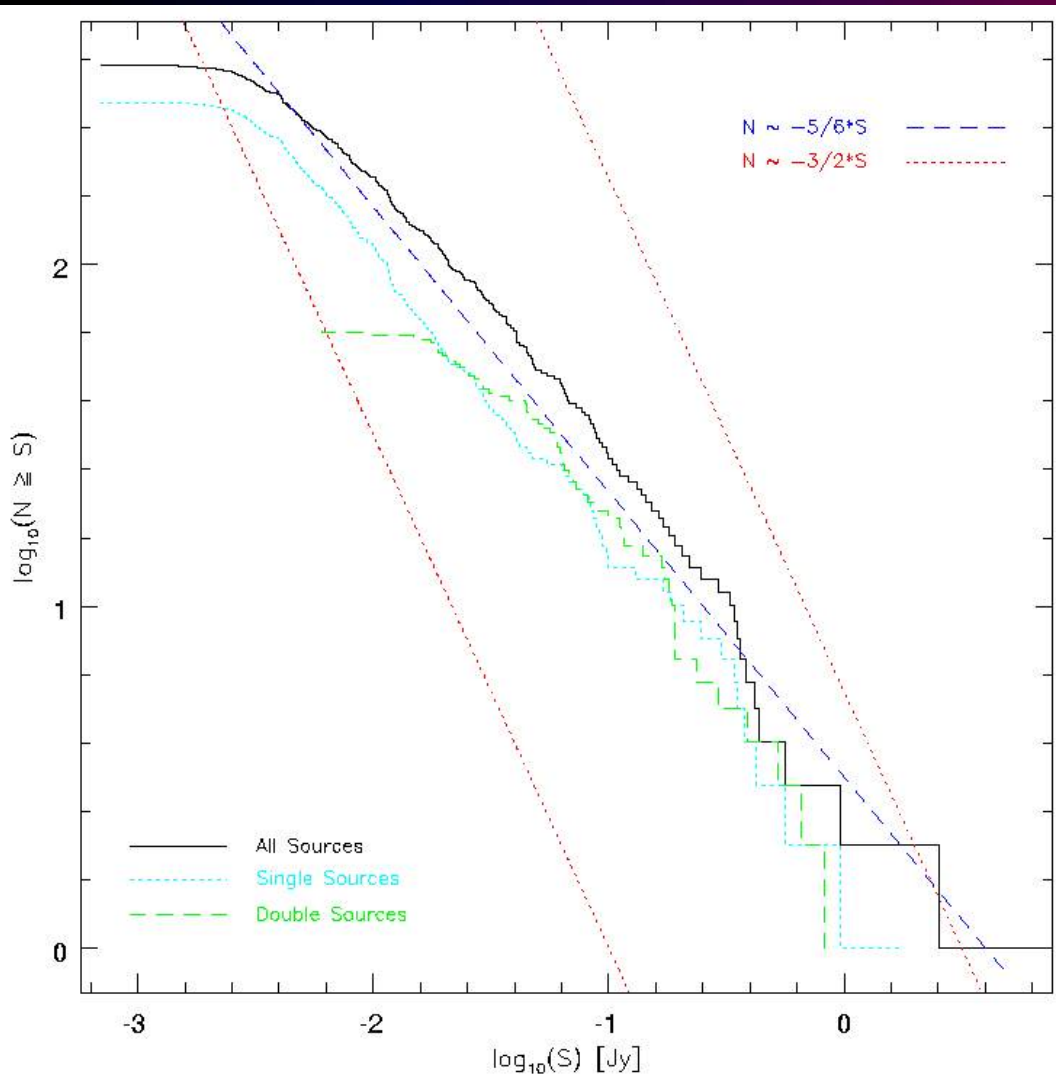
Use ~ 3 degree diameter image, with 5'' beamsize, to build source statistics

~ 1800 arcseconds



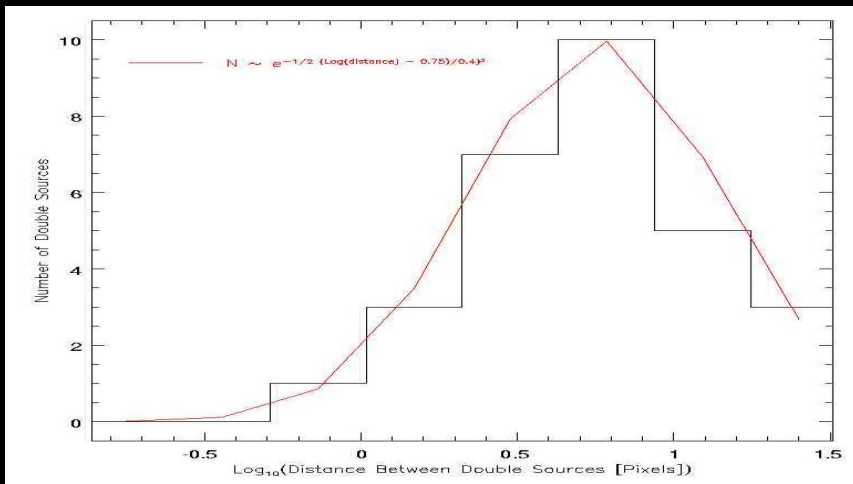
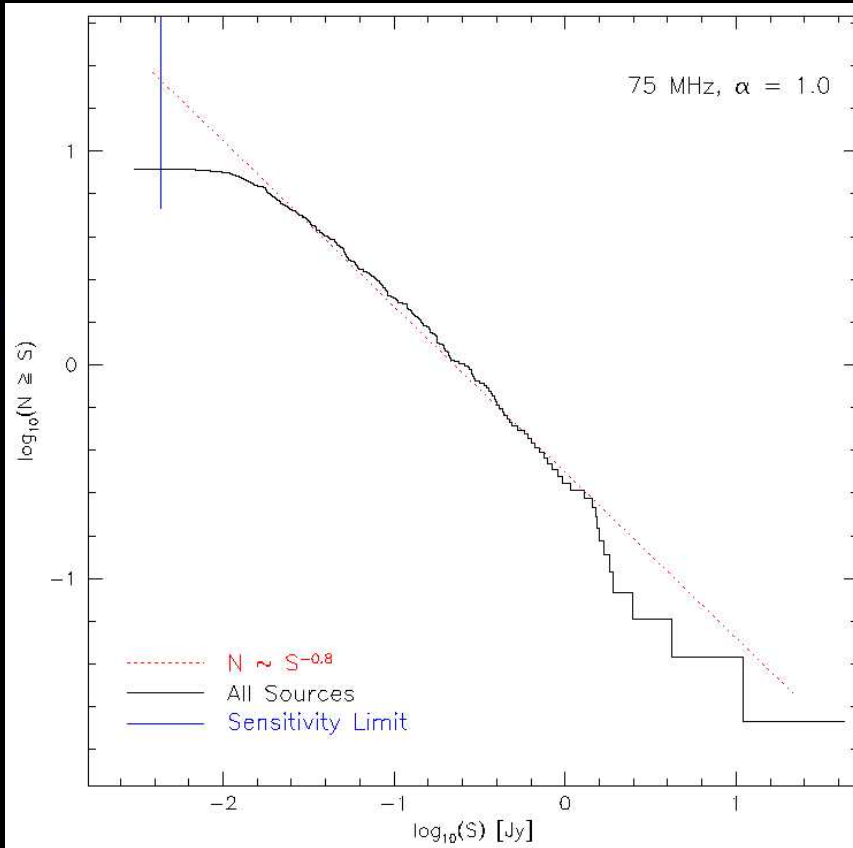
# What Do We Find?

## Number of Sources vs. Flux Density of those Sources



- $N(S) \propto (S/S_0)^{\text{constant}}$
- Source counts stop increasing at some cutoff where noise swamps sources
- Doubles falling off early – AGN's vs. starburst galaxies?

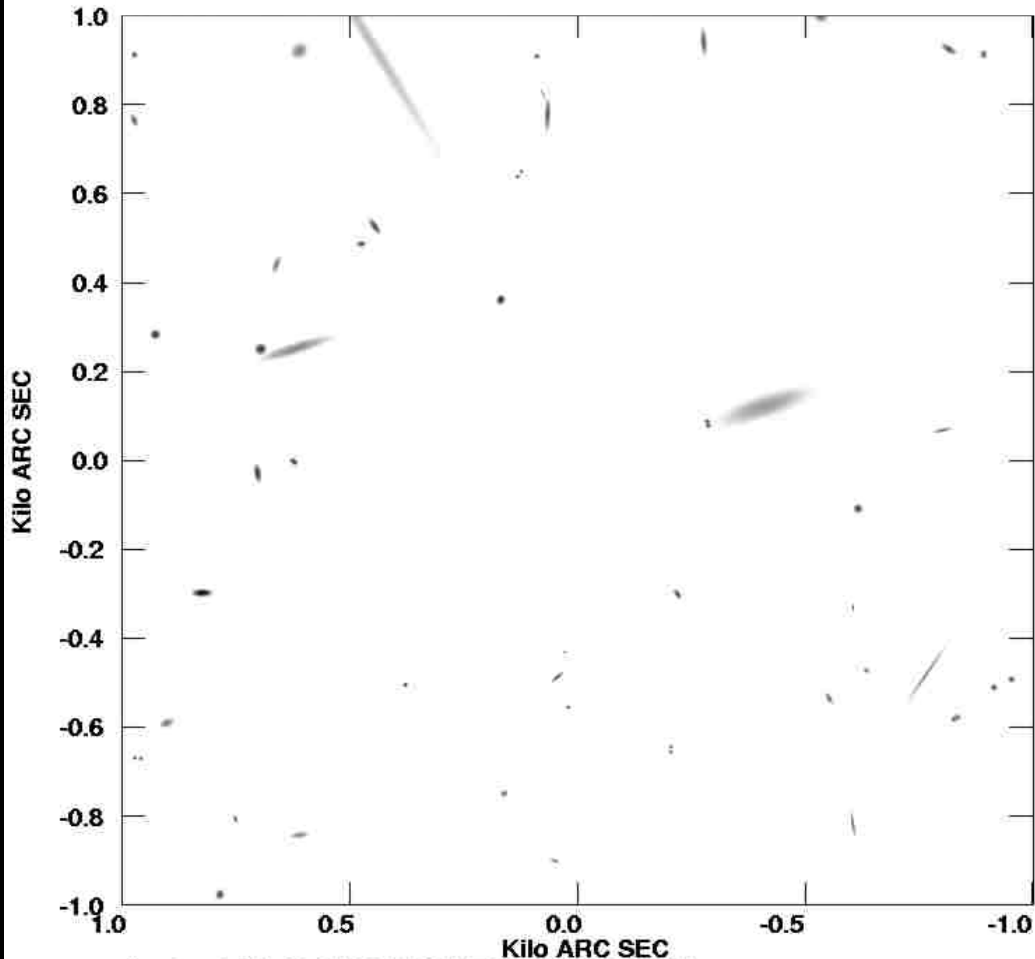
# The Model



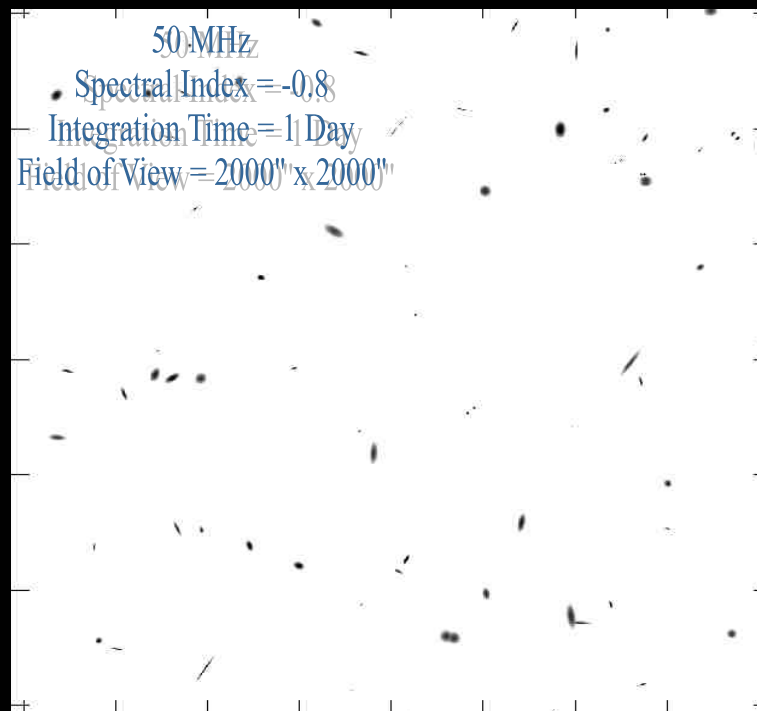
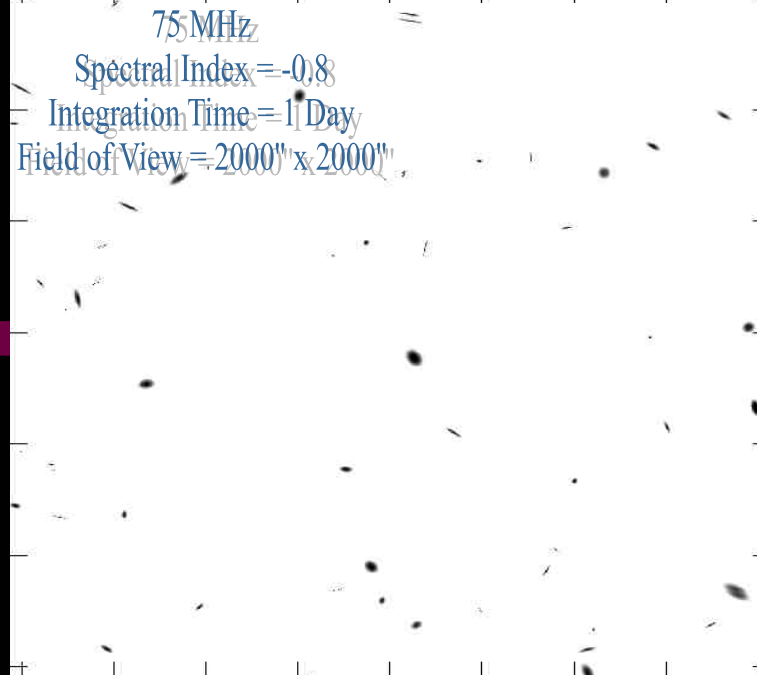
- Use a given spectral index (or statistical distribution of indices) to extrapolate to the desired frequency
- Combine this with a frequency-dependent flux density limit to generate source counts, types, and flux densities
- Randomly generate locations and angles of inclination
- Use purely empirical fits to the 328-MHz data to randomly generate distances between doubles, source sizes, and eccentricities

# The Results: Some Example Skies

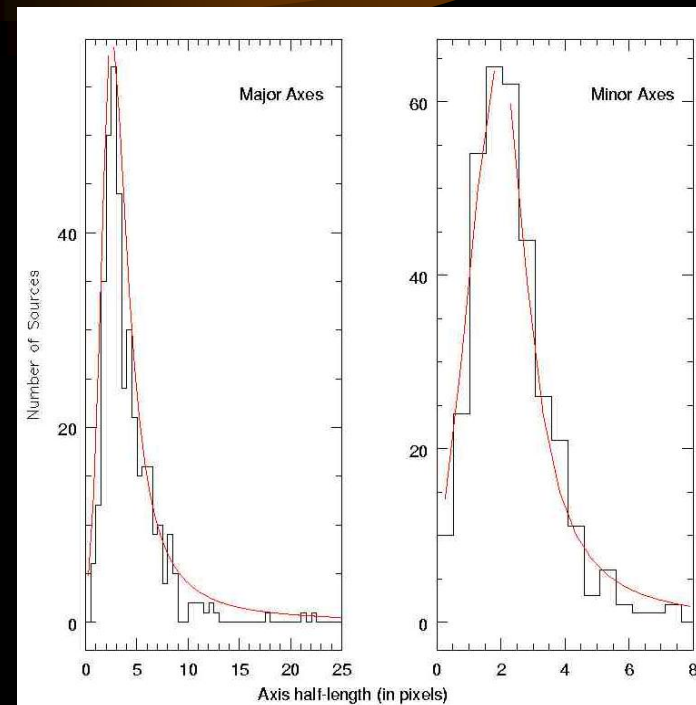
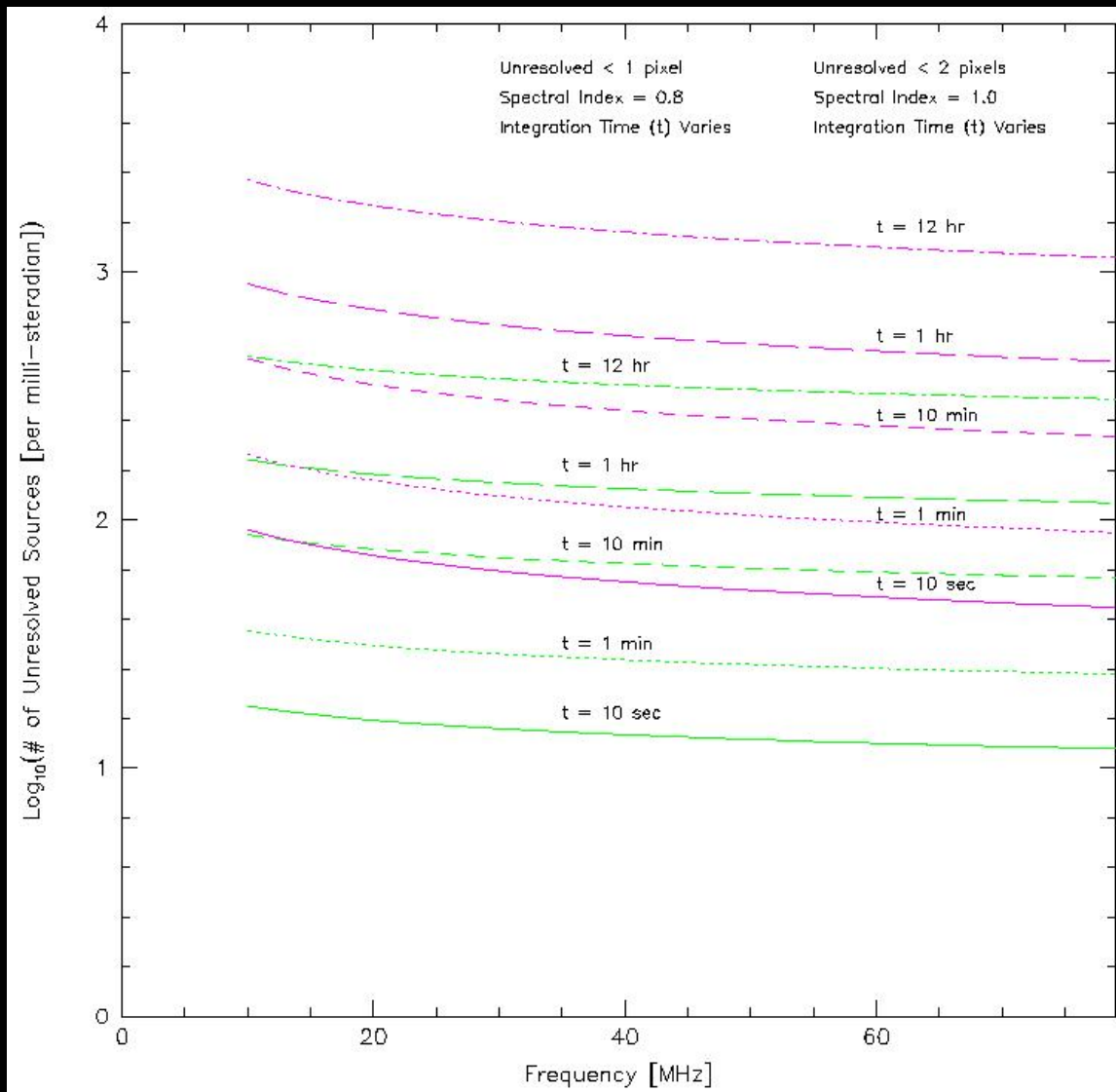
Plot file version 1 created 05-AUG-2003 12:53:19  
IPOL 74.000 MHZ GENIMG.74.1059



Colors on a log scale (from  $\sim 0.01$  mJy to  $\sim$  Jy)



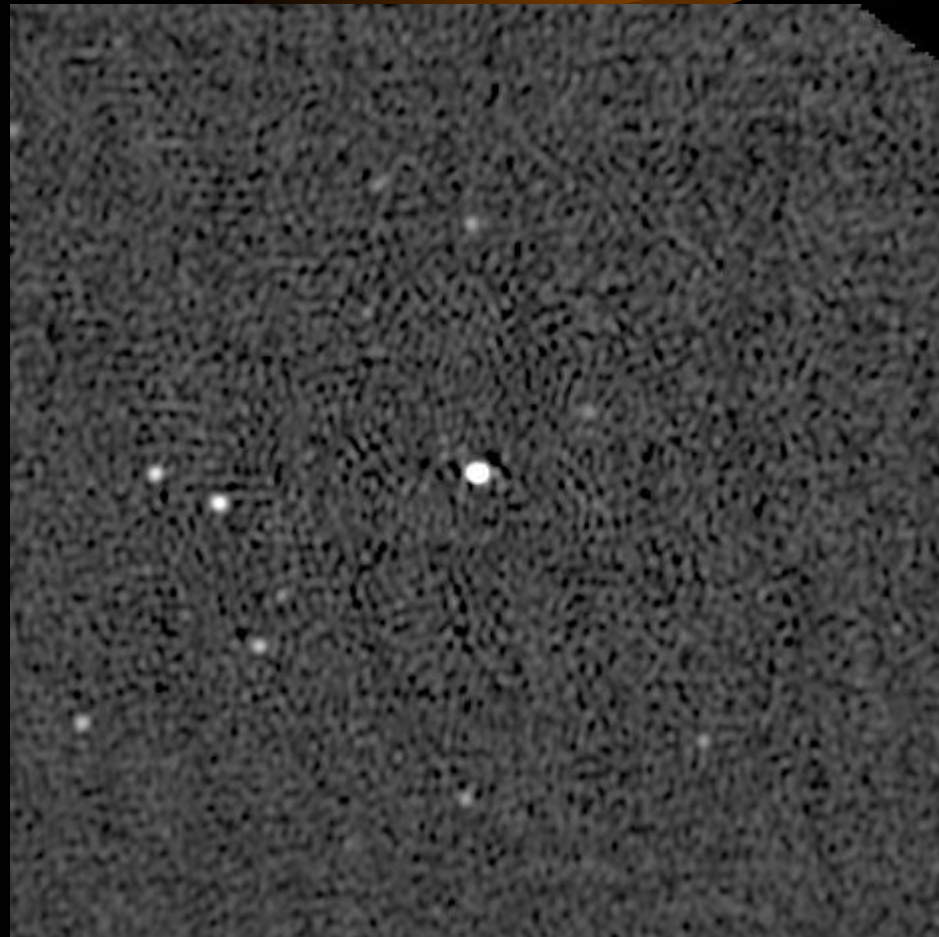
# The Results: Resolved vs. Unresolved Sources

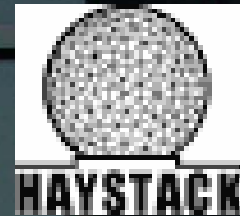


How far do we trust  
'JMFit'?

# *Where to From Here?*

- Many uncertainties still “floating around,” but some can be constrained
  - Corrections to the data for primary beam, bandwidth smearing
  - Examination of VLA and 4MASS 74-MHz data to determine distribution of spectral indices
  - Understanding different source populations, with different statistical characteristics
- Generating skies for use with the LOFAR calibrator simulation software





Massachusetts Institute of Technology  
HAYSTACK OBSERVATORY

# *Acknowledgements*



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