# Preliminary Results from Wideband VLBA Polarimetric Observations of Gamma-ray Bright Blazars

Justin Linford (UNM)
New Mexico Symposium
November 30, 2012

Collaborators:
Gregory Taylor (UNM)
Frank Schinzel (UNM)
Robert Zavala (USNO)

Image by Aurore Simonnet
NASA E/PO
Sonoma State University

THE UNIVERSITY of NEW MEXICO

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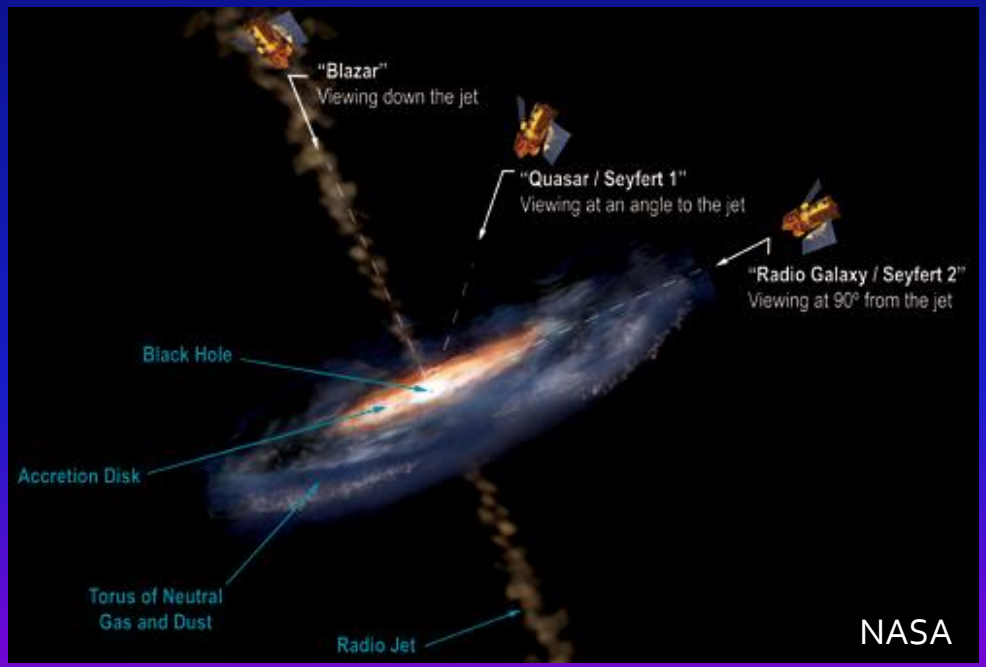
# Blazars

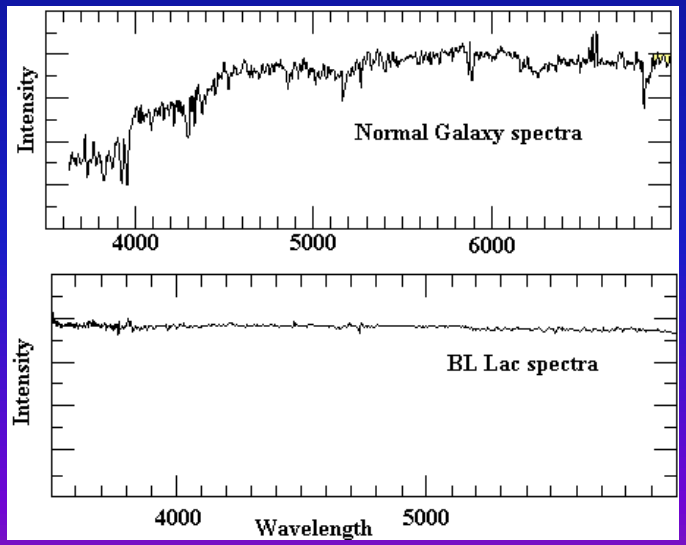




- AGN with one jet pointed nearly straight at us
- High variability
- Typically one-sided jet morphology
- Apparent superluminal motion in the jet

# Blazar Types

## BL Lacs

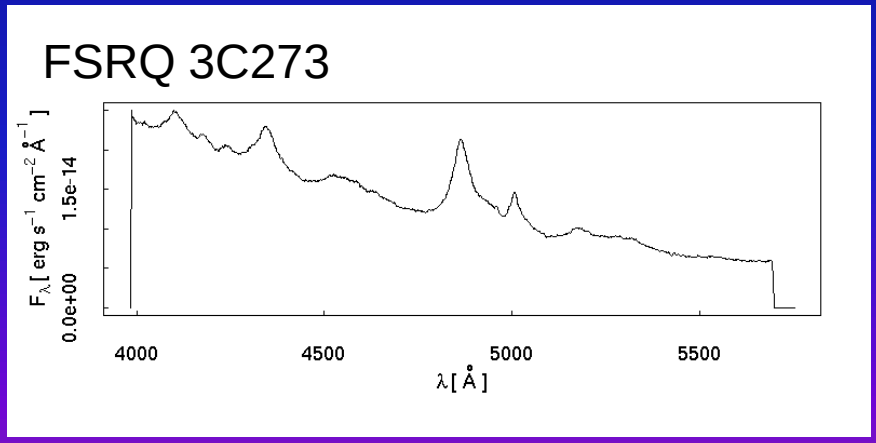
- BL Lacertae objects
- Flat, almost featureless optical spectra




Siobahn Morgan, UNI

## FSRQs

- Flat-spectrum radio quasars
- Broad emission lines in optical spectra




Koratkar & Blaes 1999

# The Sample

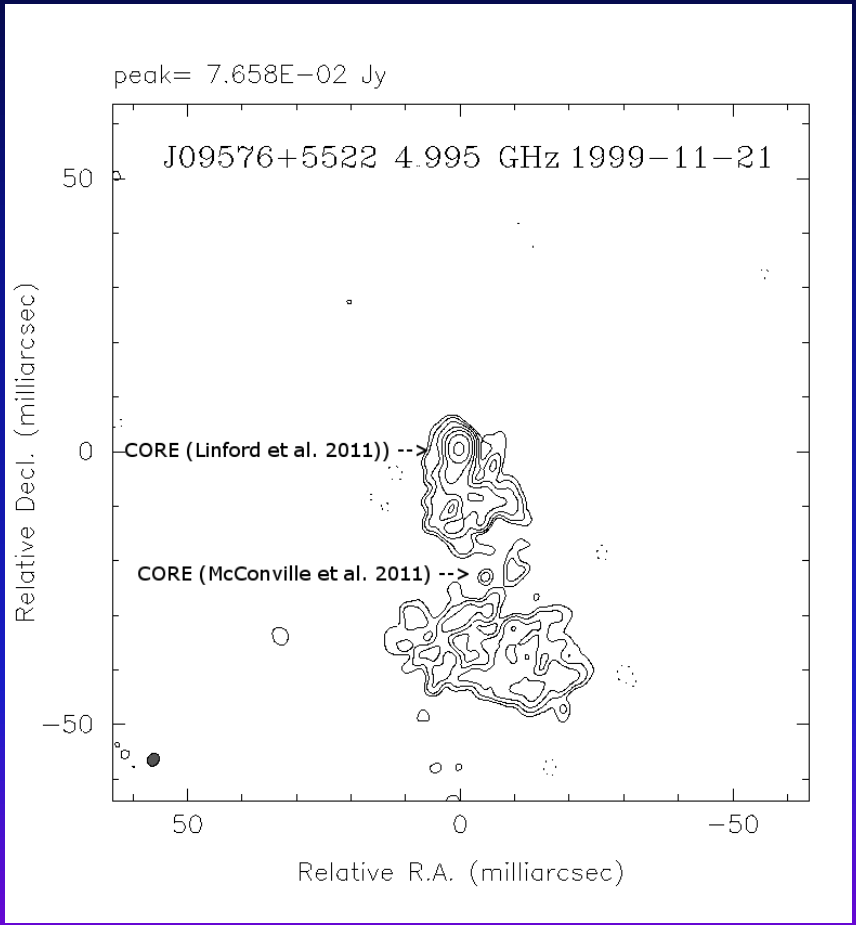
- 24 blazars detected by the Large Area Telescope (LAT) on board the Fermi Gamma-ray Space Telescope
  - 14 flat-spectrum radio quasars (FSRQs)
  - 10 BL Lacertae objects
- All observed at 8.5, 15, and 22 GHz
- Used 2Gbps mode (256 MHz total bandwidth, full polarization)

# Teething Troubles

## or "So that's why it's called 'shared risk'"

- First observing run: lost Tsys values on Brewster for the entire run
- Second observing run: lost Tsys values on all antennas for 4 of the 8 IFs for the entire run, Pie Town antenna down for entire run
- Third observing run: good
- Fourth observing run: major problems with Mauna Kea antenna, had to re-observe

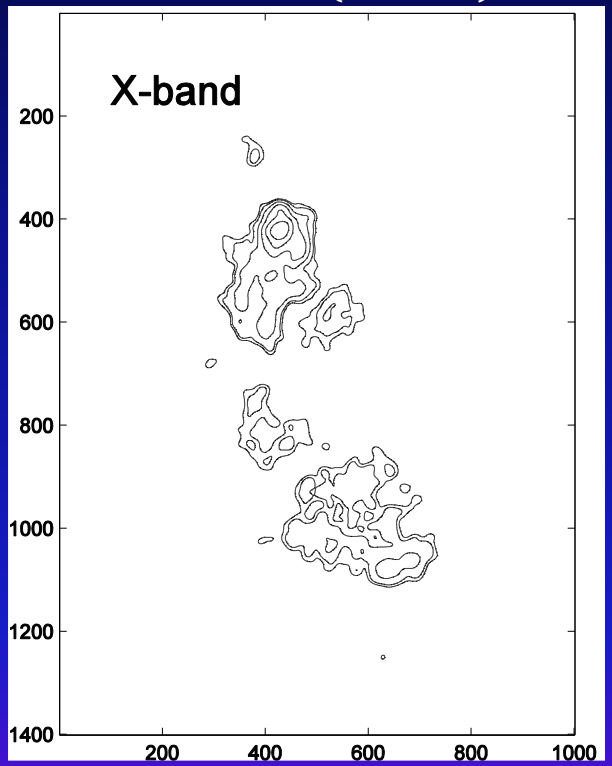
# 4C +55.17



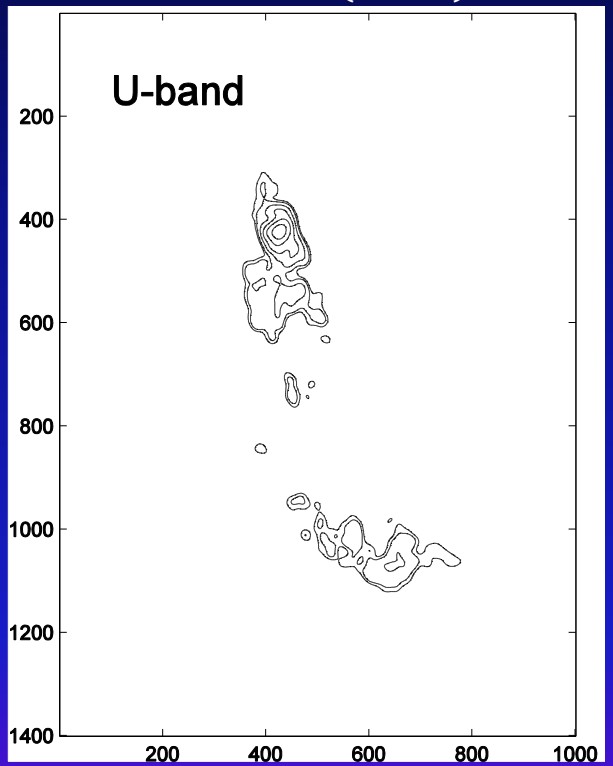

- Usually classified as a FSRQ
- McConville et al. (2011) claim it could be a compact symmetric object (CSO)
- If so, it would be the only LAT-detected CSO to date

# Observations of 4C +55.17

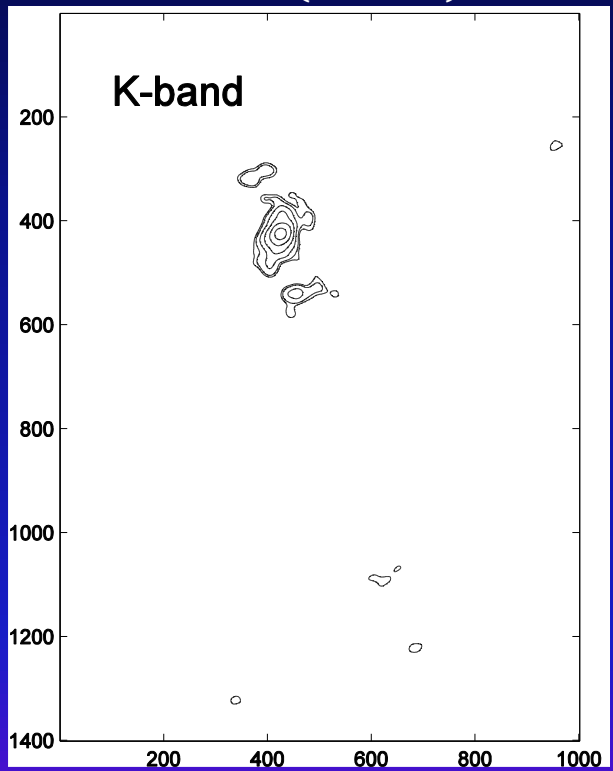
8.4 GHz (3.5 cm)




15 GHz (2 cm)

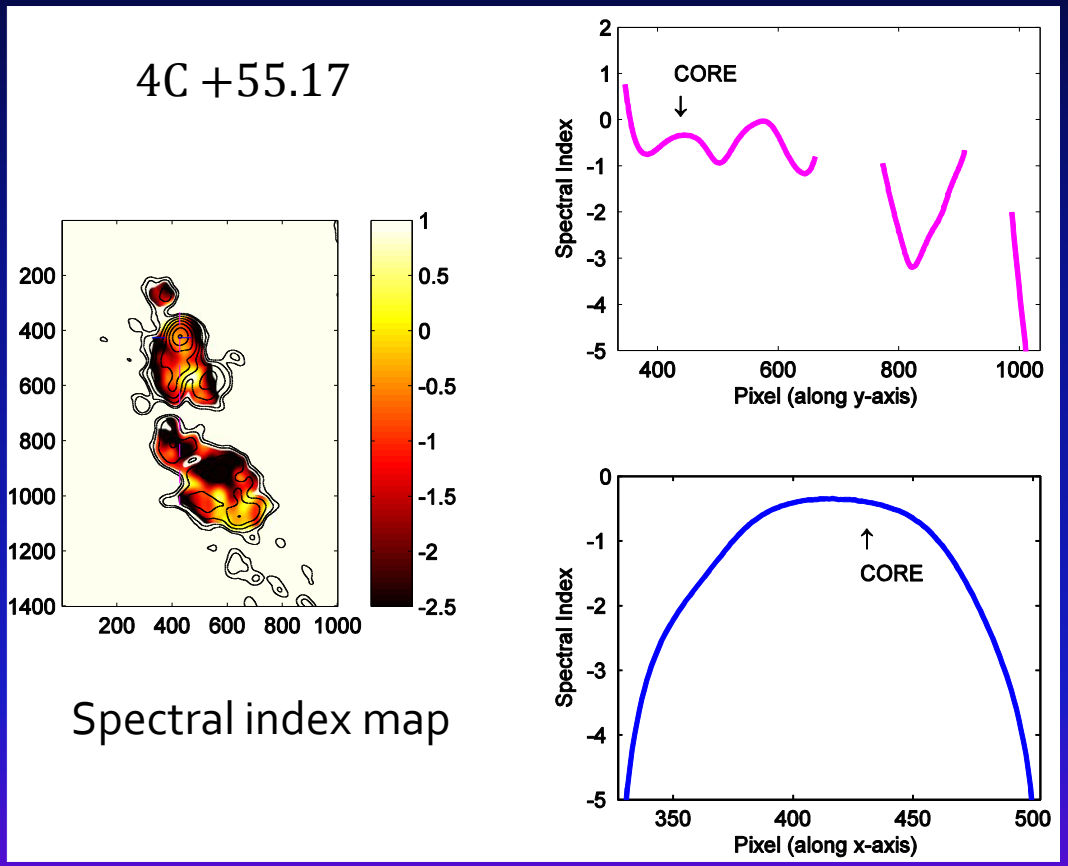



22 GHz (1.4 cm)




Note that the jet flux decreases with frequency

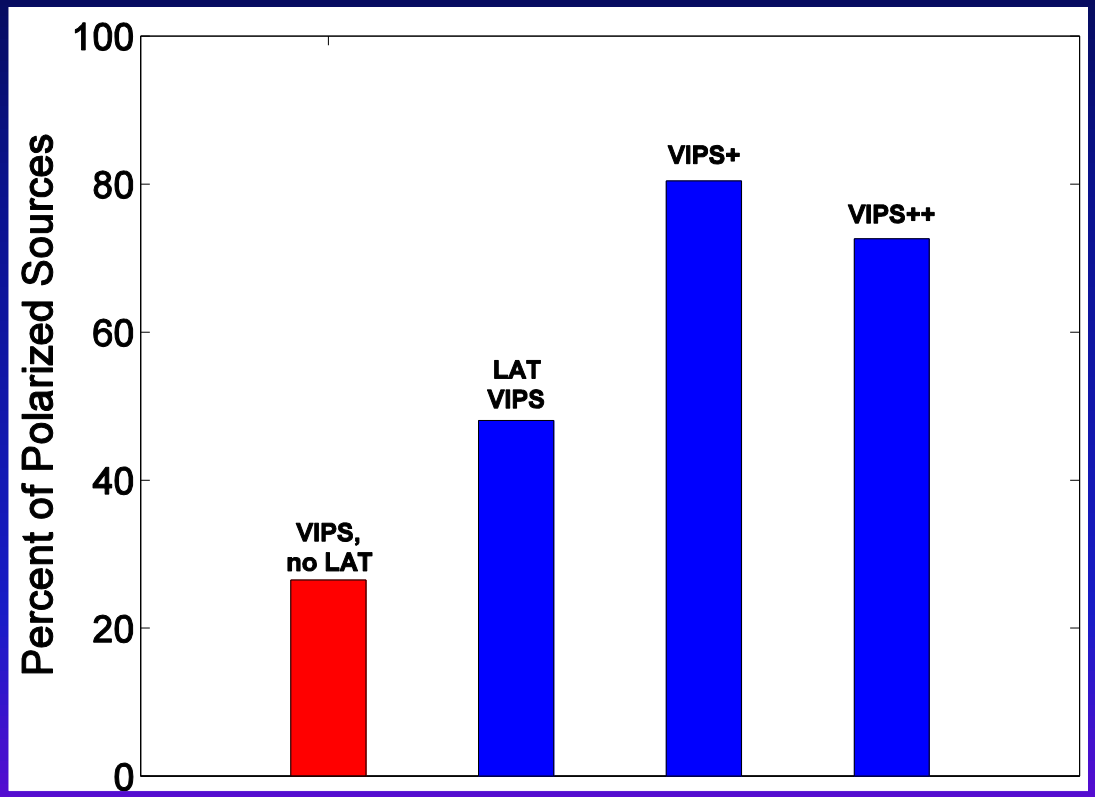
# Spectral Index Map



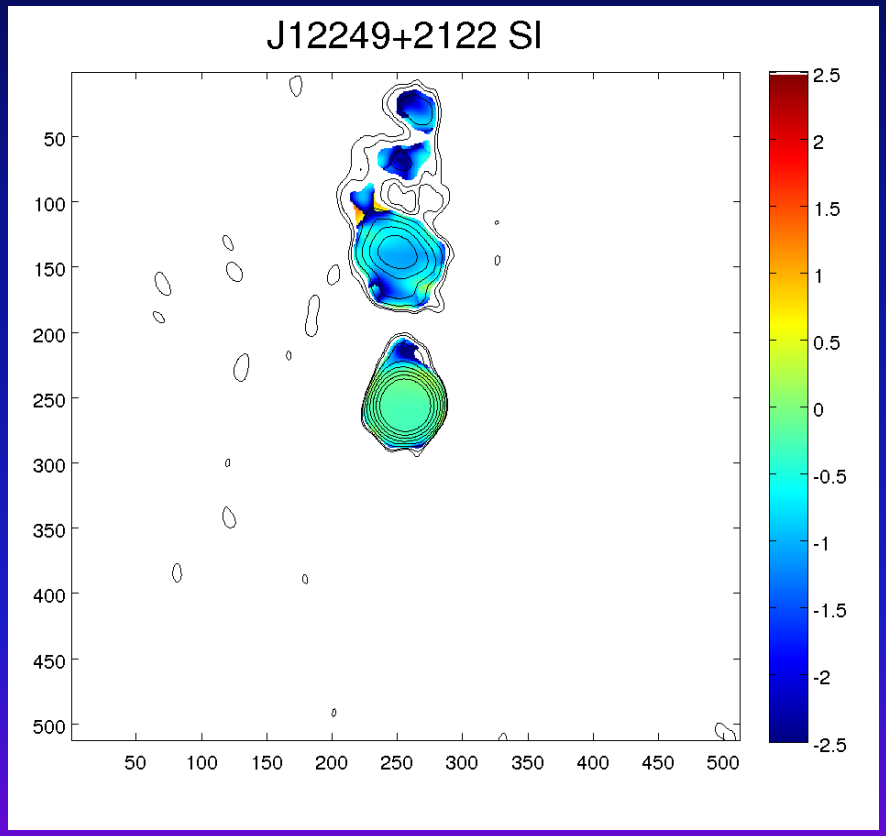

- Spectral index α: $S \sim \nu^{\alpha}$
- Spectral index map (using 8.4 and 15 GHz data) indicates that it is NOT a CSO
- Flat spectral index associated with our core
- No evidence of a flat spectral index at McConville's core

# Why Look at Polarization?

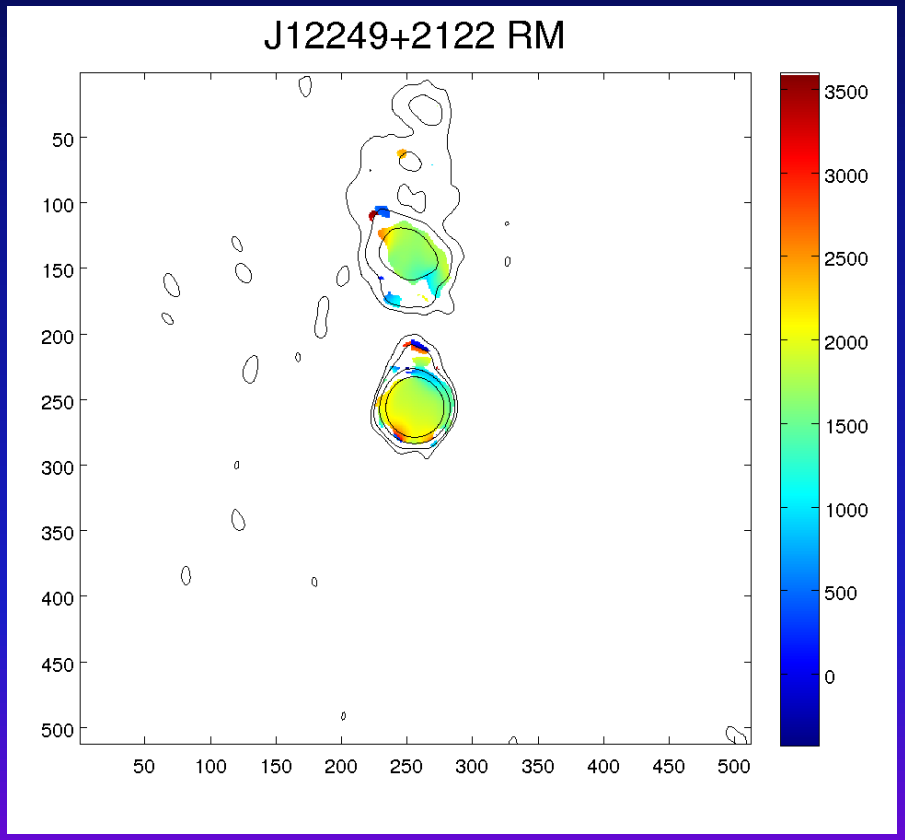
- Gamma-ray sources are more likely to have polarized cores
  - LAT: 176/232 (75.9%)
  - Non-LAT: 270/1018 (26.5%)
- Strong, uniform magnetic fields in the cores are tied to γ-ray emission



# J12248+2122 (FSRQ)

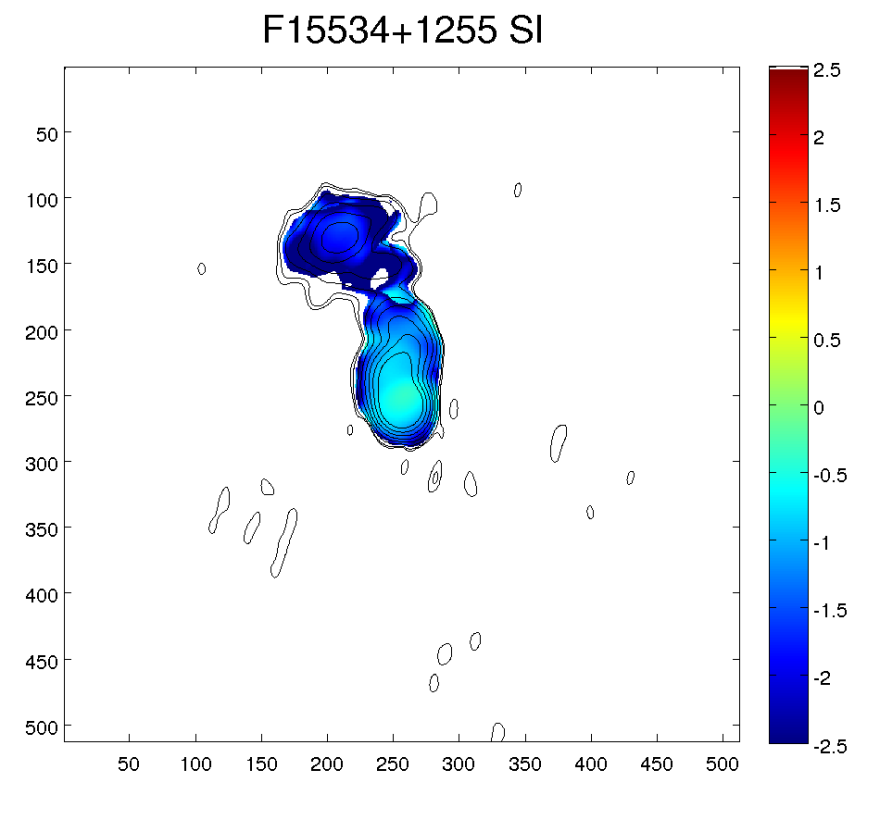



Contour Levels (mJy): 1.5, 2.1, 4.2, 8.4, 17, 34, 68, 136

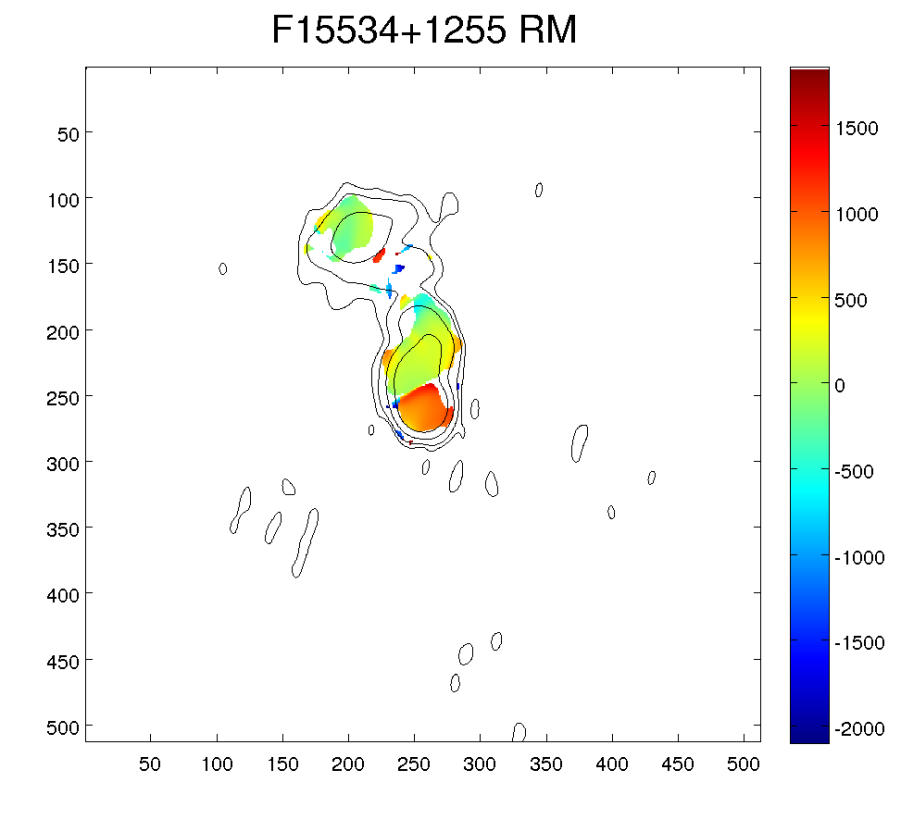



Contour levels (mJy): 1.5, 4.2, 17, 68

# F15534+1255 (FSRQ)

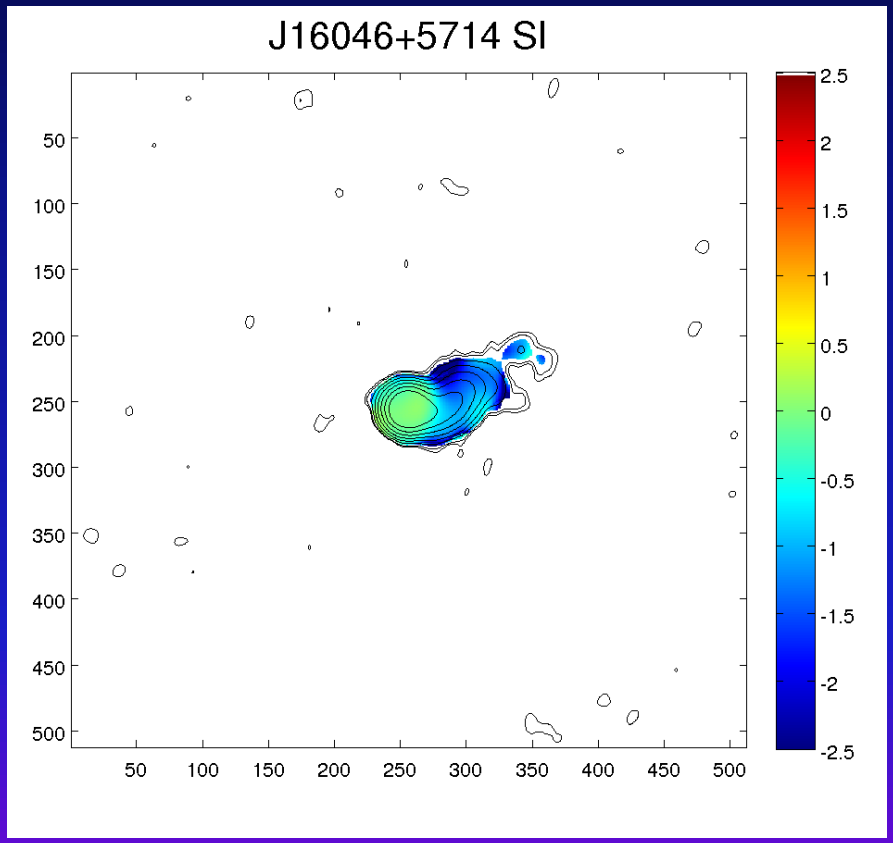


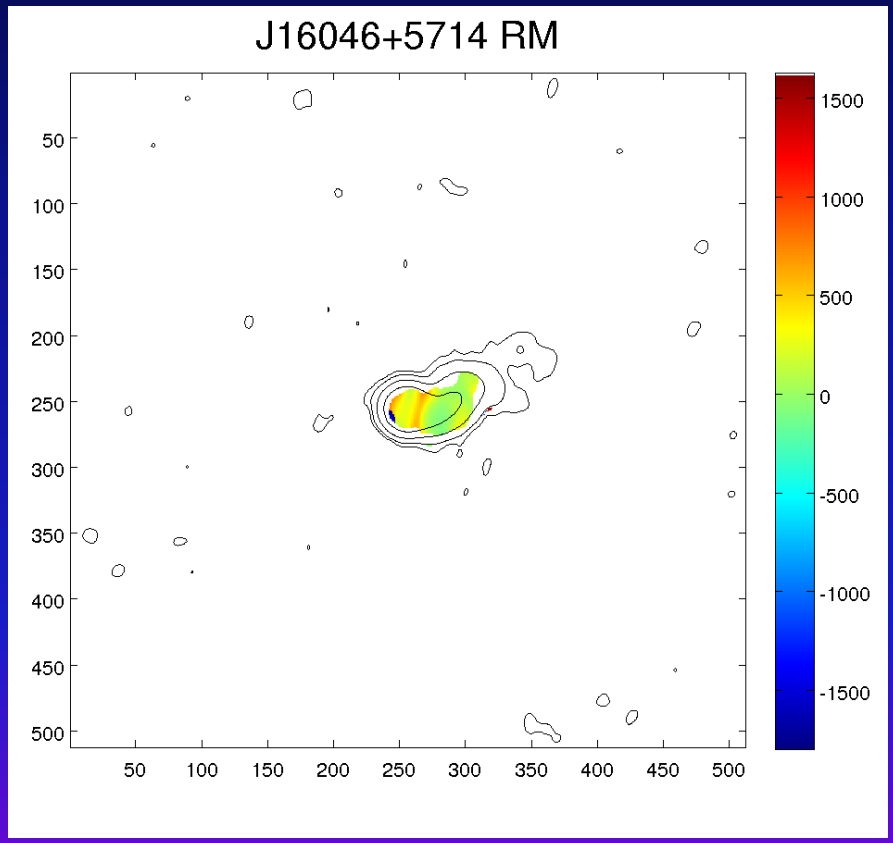

Contour Levels (mJy): 0.9, 1.2, 2.4, 4.8, 9.6, 19, 38, 77




Contour Levels (mJy): 0.8, 2.4, 9.6, 38

# J16045+5714 (FSRQ)

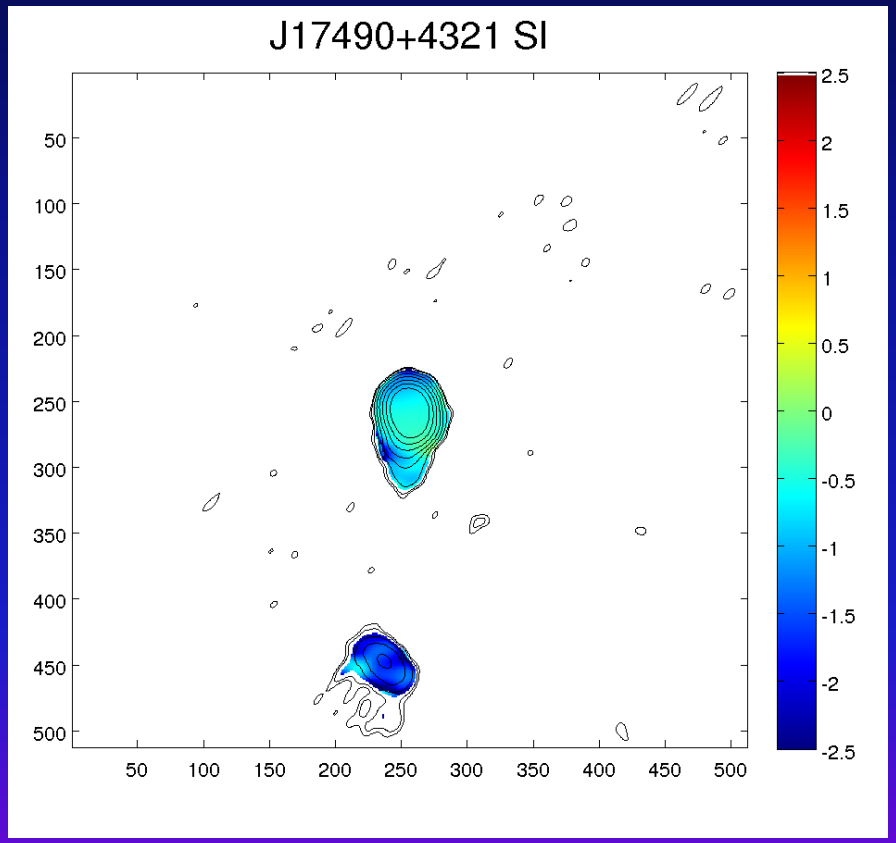


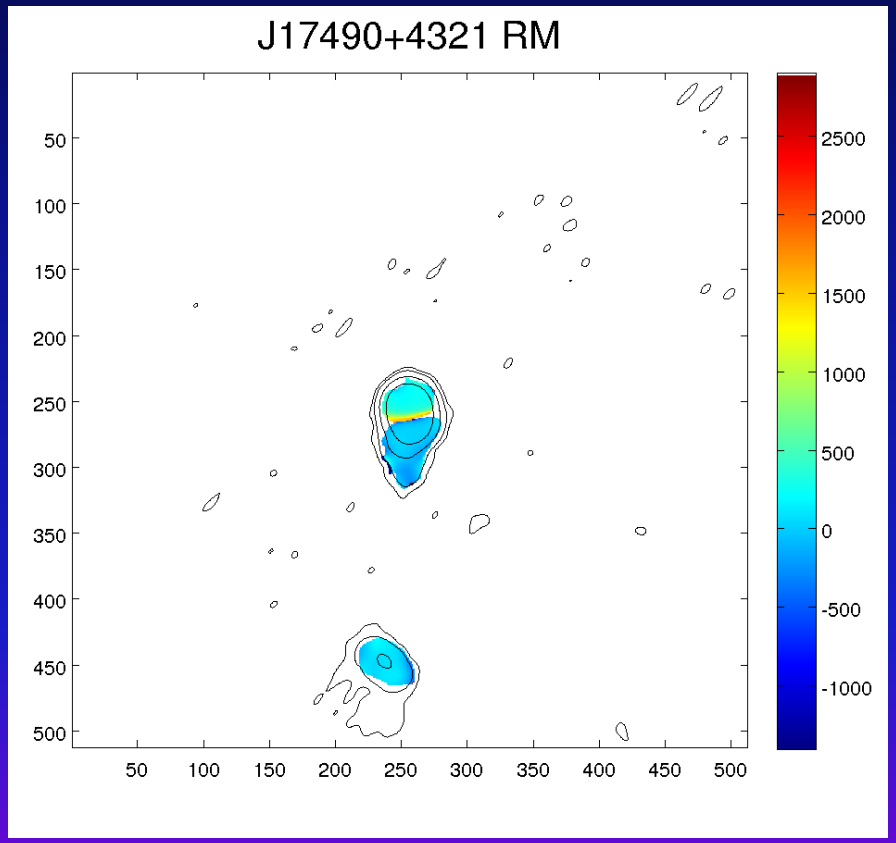

Contour Levels (mJy): 0.6, 0.8, 1.6, 3.3, 6.5, 13, 26, 52

Contour Levels (mJy): 0.6, 1.6, 6.5, 26

# J17490+4321 (BL Lac)




Contour Levels (mJy): 0.8, 1.2, 2.3, 4.7, 9.3, 19, 37, 75




Contour Levels (mJy): 0.8, 2.3, 9.3, 37

# So Far…

- Our findings are consistent with other studies (e.g., Taylor & Zavala 2004)
  - Cores tend to have higher RM (~1000)
  - Jets tend to have lower RM (~100)
    - Indicating cores have higher density
- As yet, no evidence for RM gradients across resolved jets

# What's Next?

- Finish crunching the data
- Look for correlation between SI and RM
- Look for differences between BL Lac objects and FSRQs
- Compare our results with those presented in Hovatta et al. (2012) using the MOJAVE sample