

High Fidelity Rotation Measures Across Parsec-Scale Jets

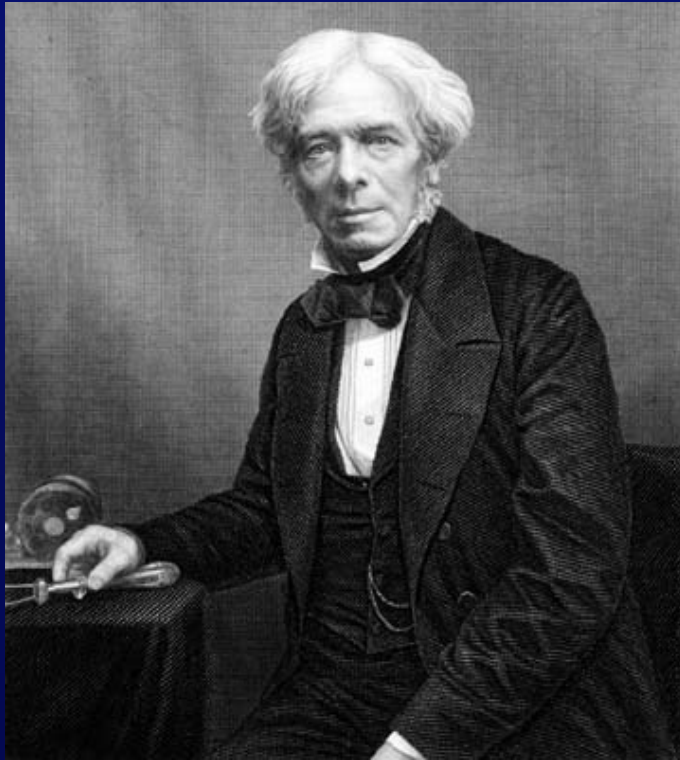
Greg Taylor (UNM/NRAO), Bob Zavala (USNO),
and Steve Tremblay (UNM)

RM 2010, Riccione, 2010 May 13

Outline

- ✧ RM gradients - 3C273 and ???
- ✧ Polarimetry of strong broad jets
- ✧ The case for RM gradients
- ✧ Bad things that can happen
- ✧ Conclusions

“Google” Faraday Rotation



Michael Faraday

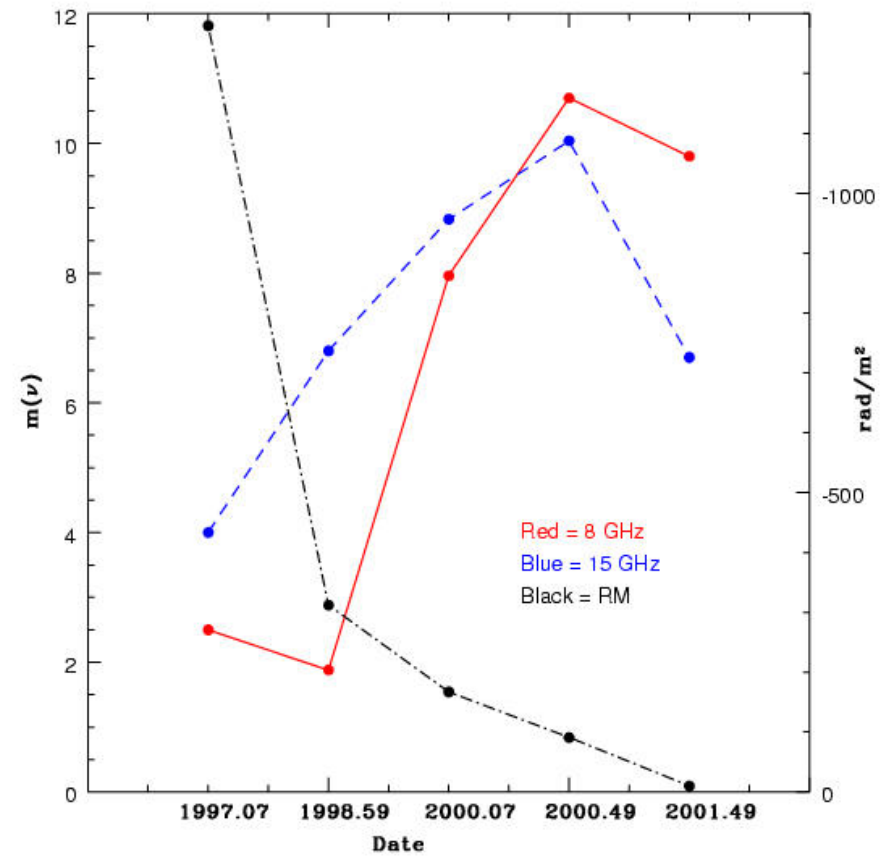
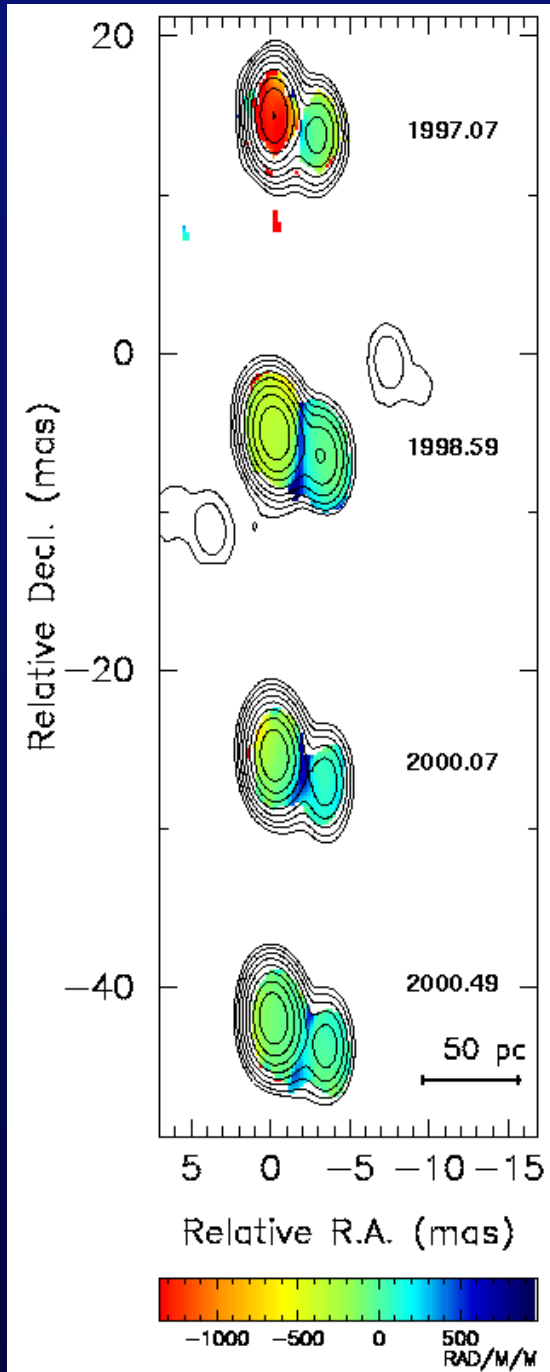


Faraday rotation,
480 x 720 - 60k - jpg
eso.org

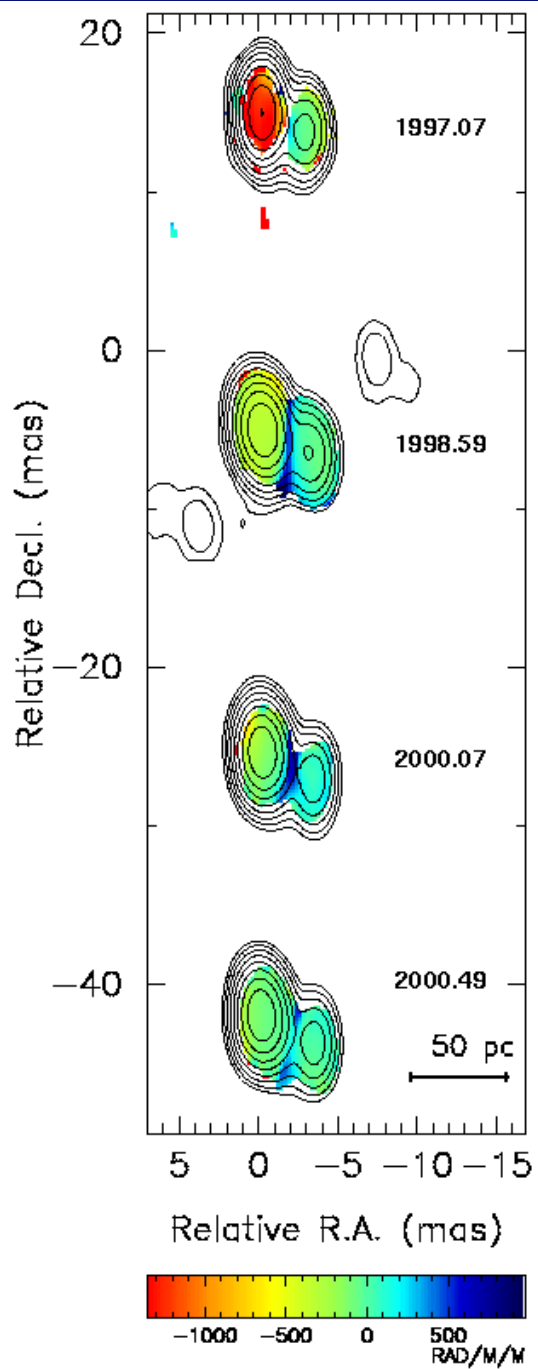
Robert Laing

Zavala & Taylor (2002)

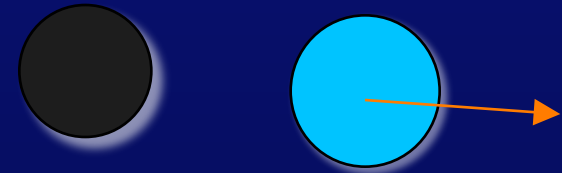
3C279 Rotation Measures changing in time



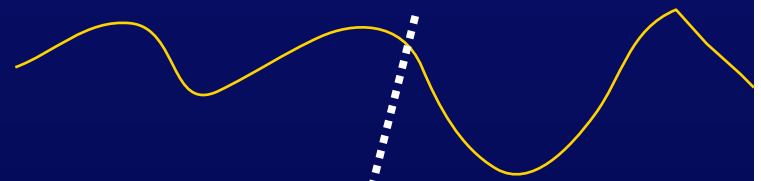
Zavala & Taylor (2002)



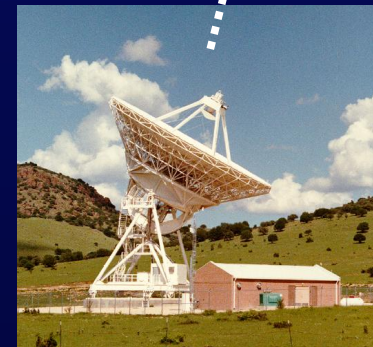
Source



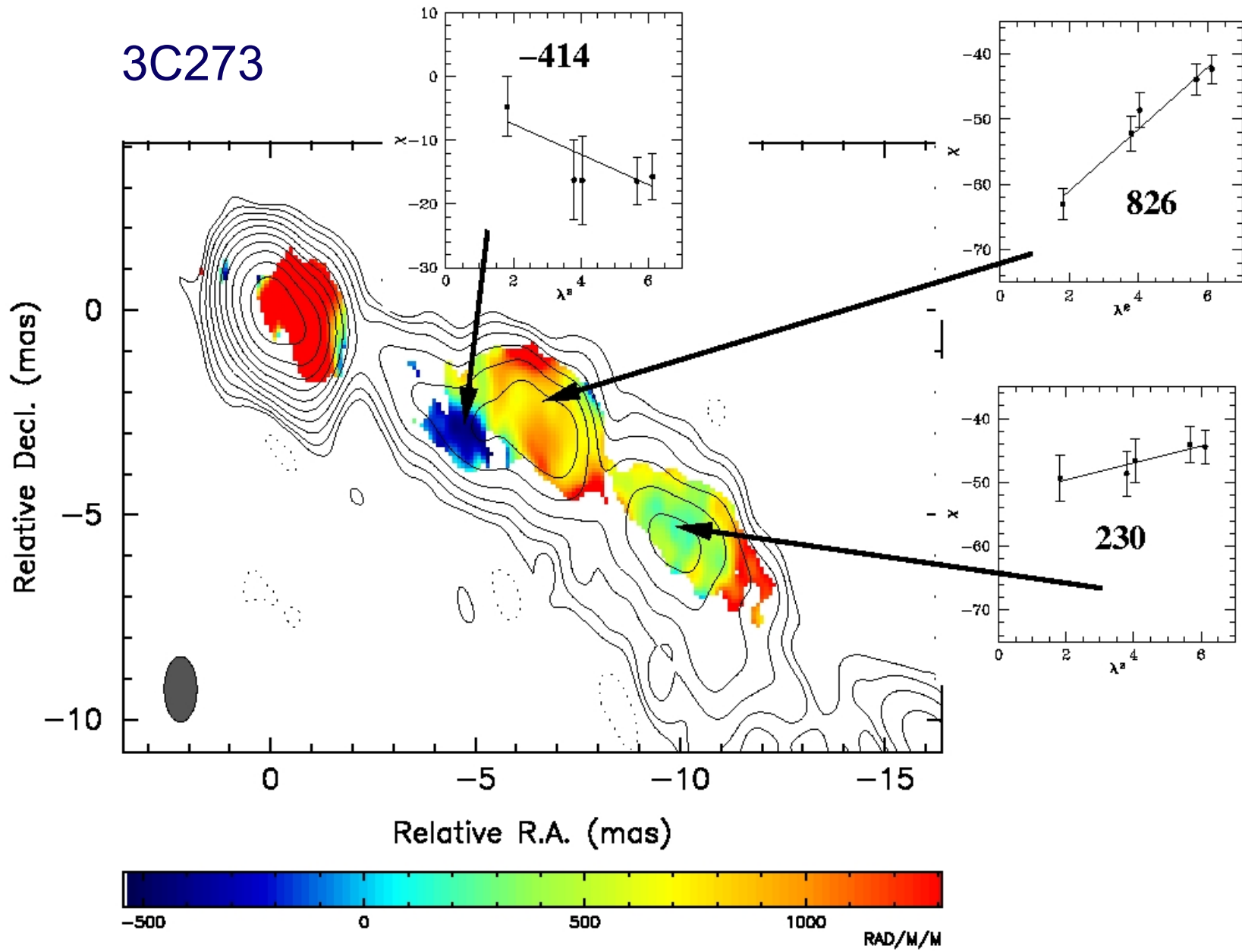
Screen

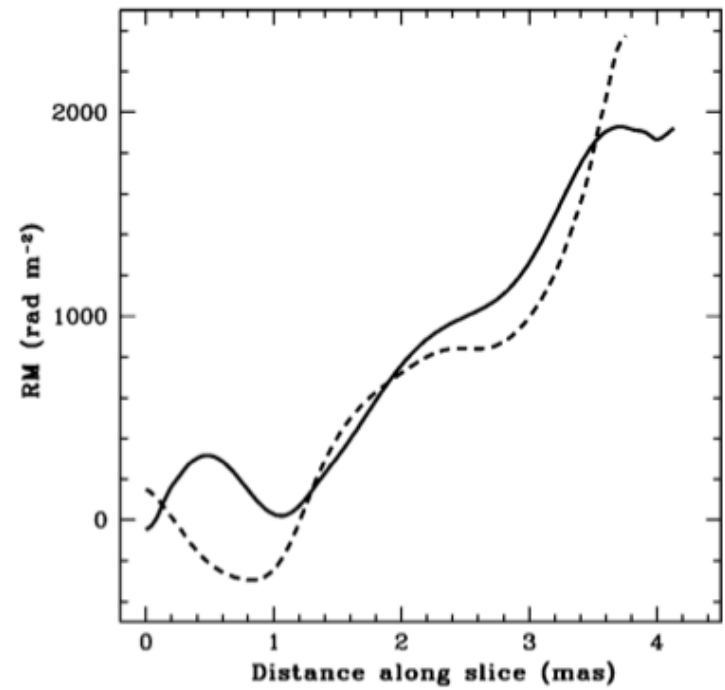
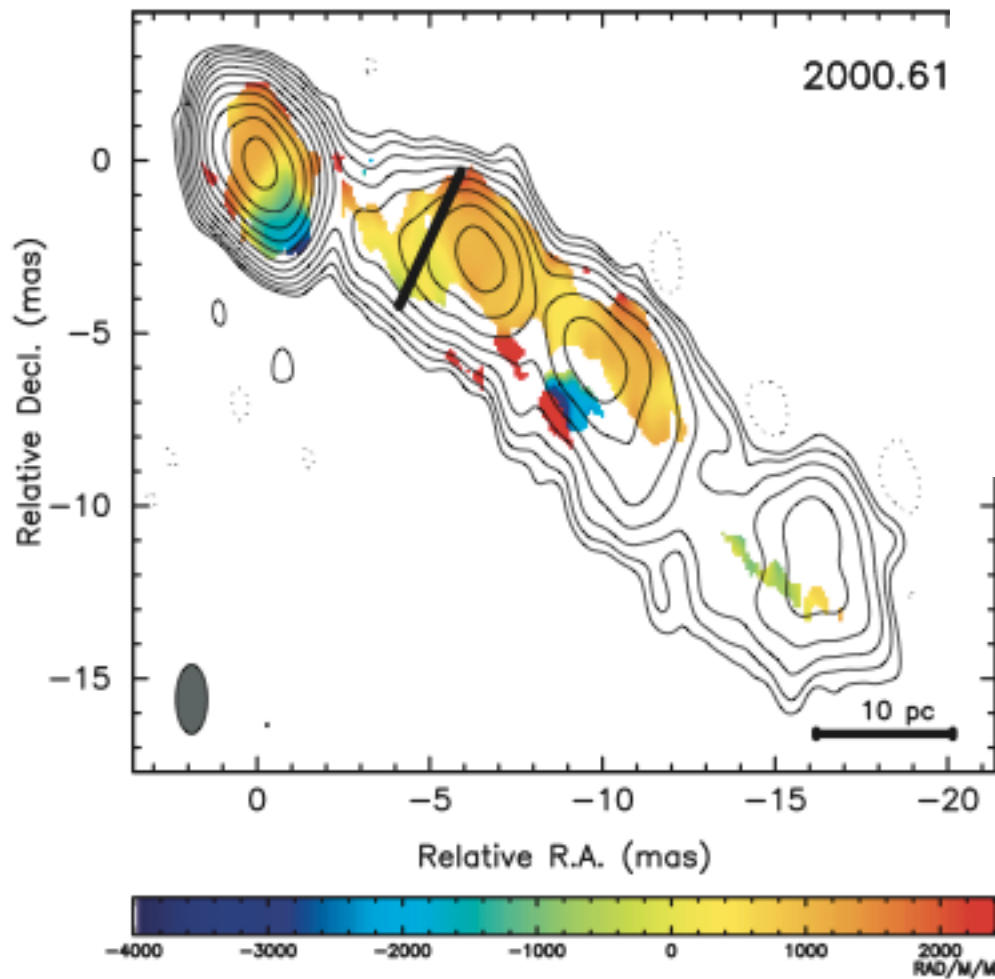


Observer



3C273

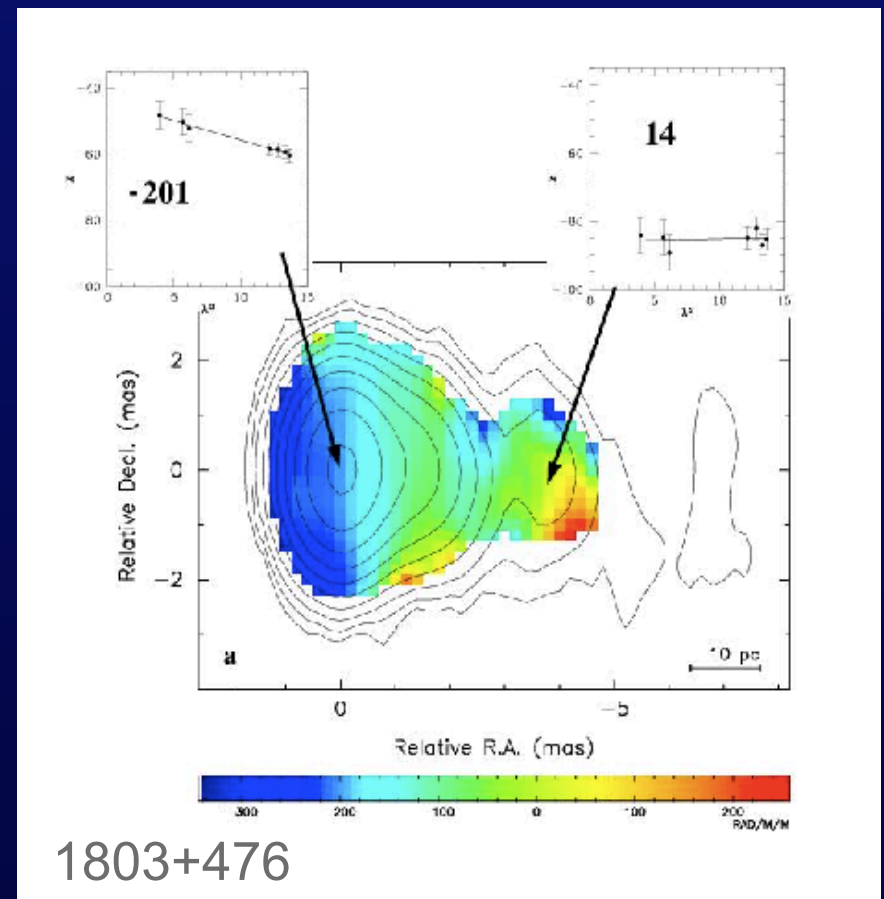
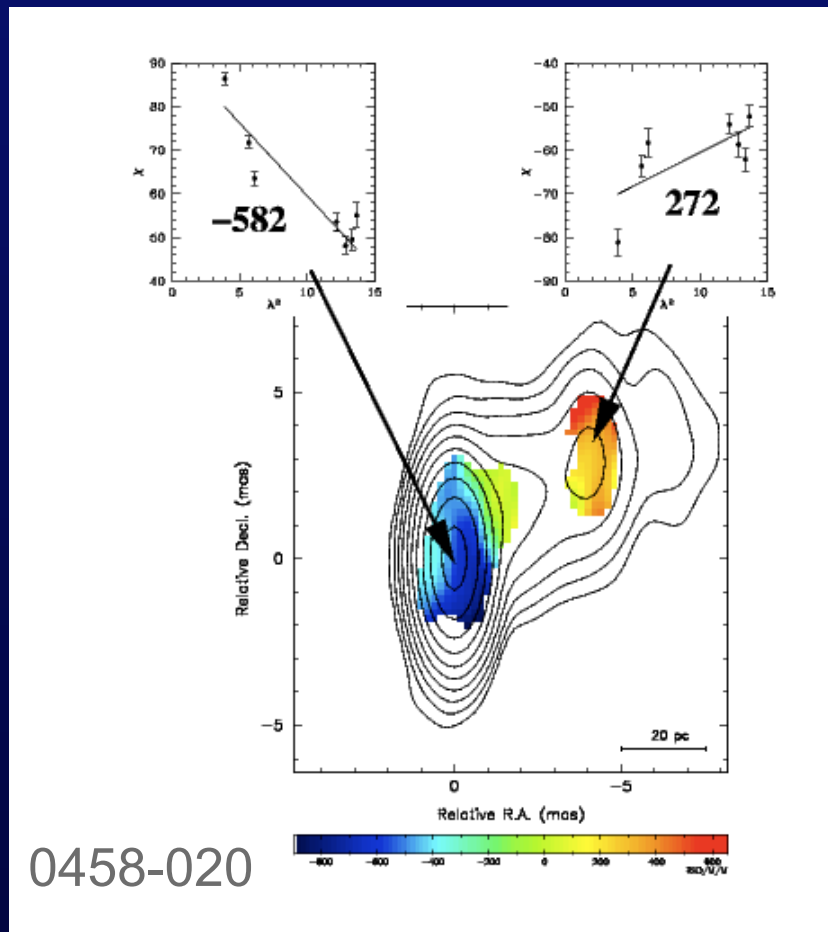




Zavala & Taylor 2005

RM Gradients

✧ Zavala & Taylor survey of 40 strong AGN:



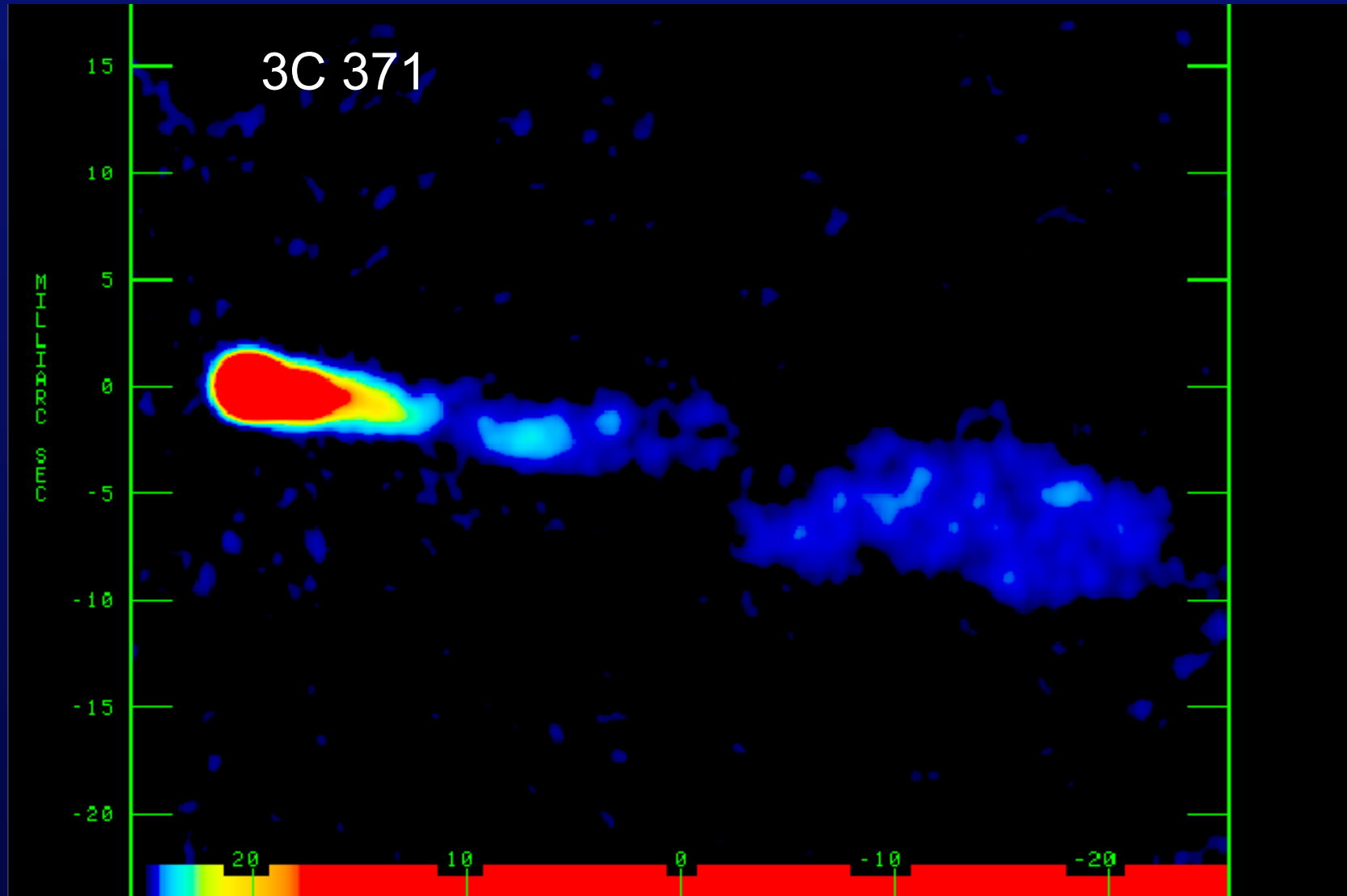
RM Gradients

- ✧ Zavala & Taylor survey of 40 strong AGN:
- ✧ 1 definite (3C273 – first reported by Asada et al.) and 2 possible

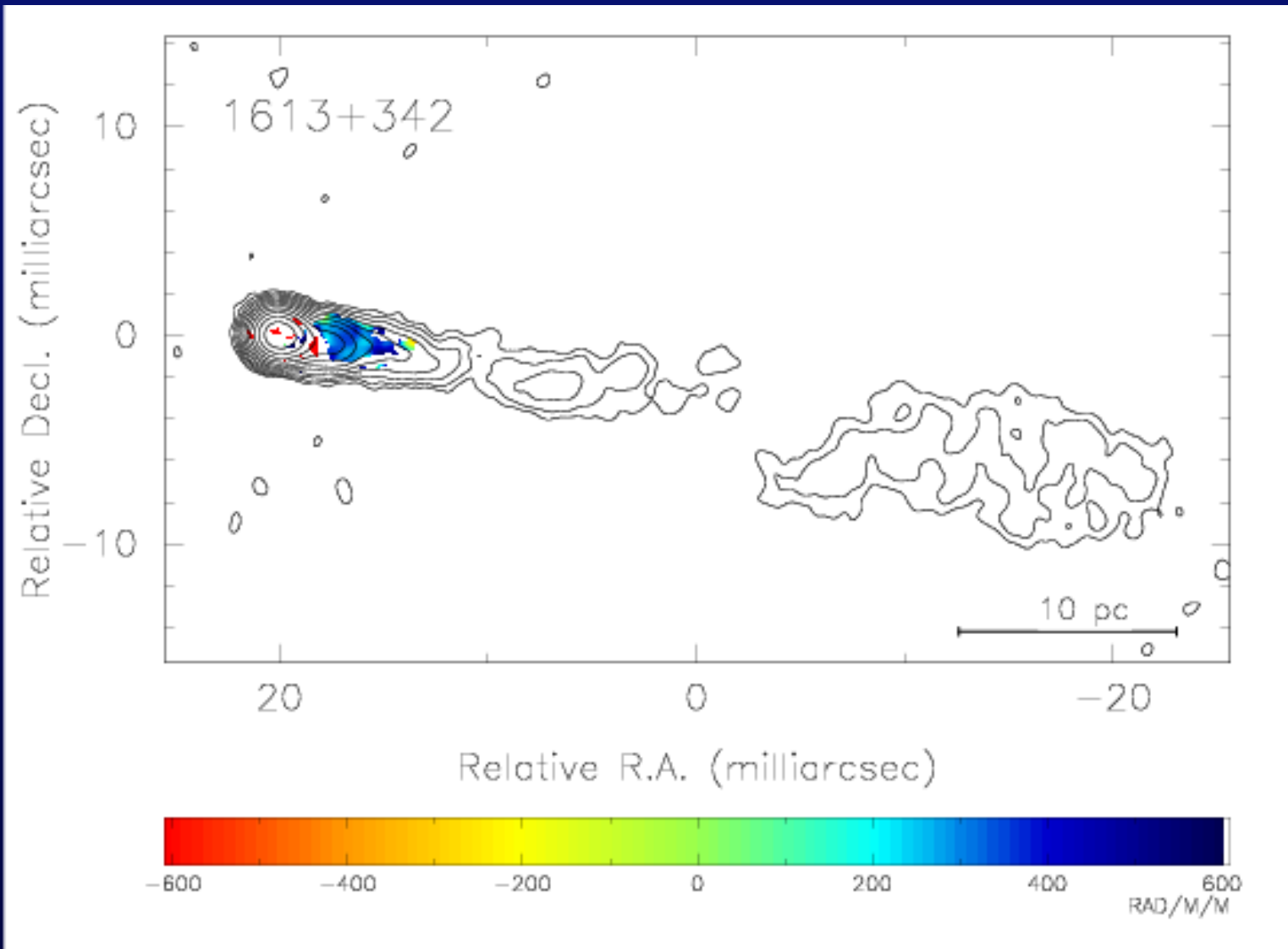
Magnetic Fields

- ✧ RM time variable
- ✧ Faraday depth gradient
- ✧ Scale size ~ 1 pc
- ✧ $B \sim 10 \mu\text{G}$ (assuming $n_e \sim 100 \text{ cm}^{-3}$)
- ✧ BL Lacs: jet RM $<$ quasars
- ✧ Testing Helical fields: need broad jets

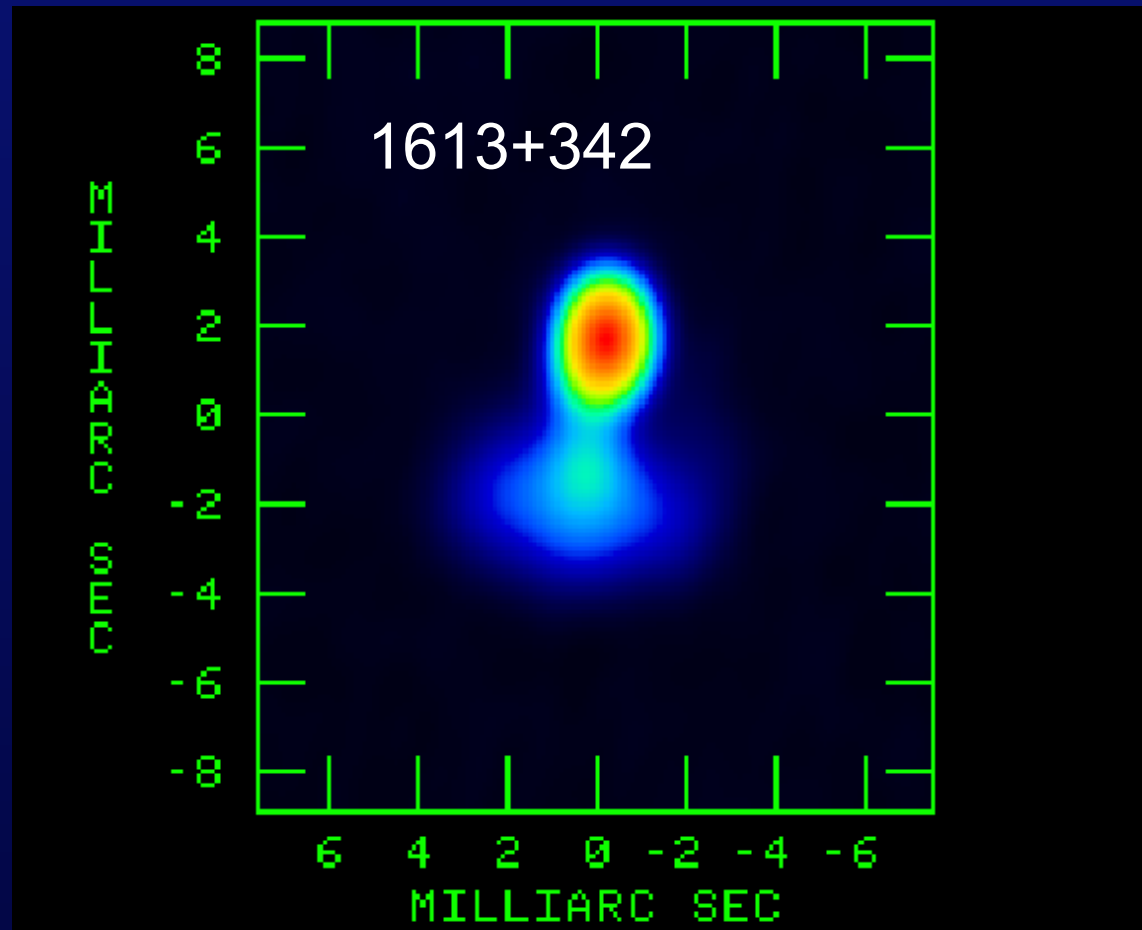
8.4 GHz Stokes I



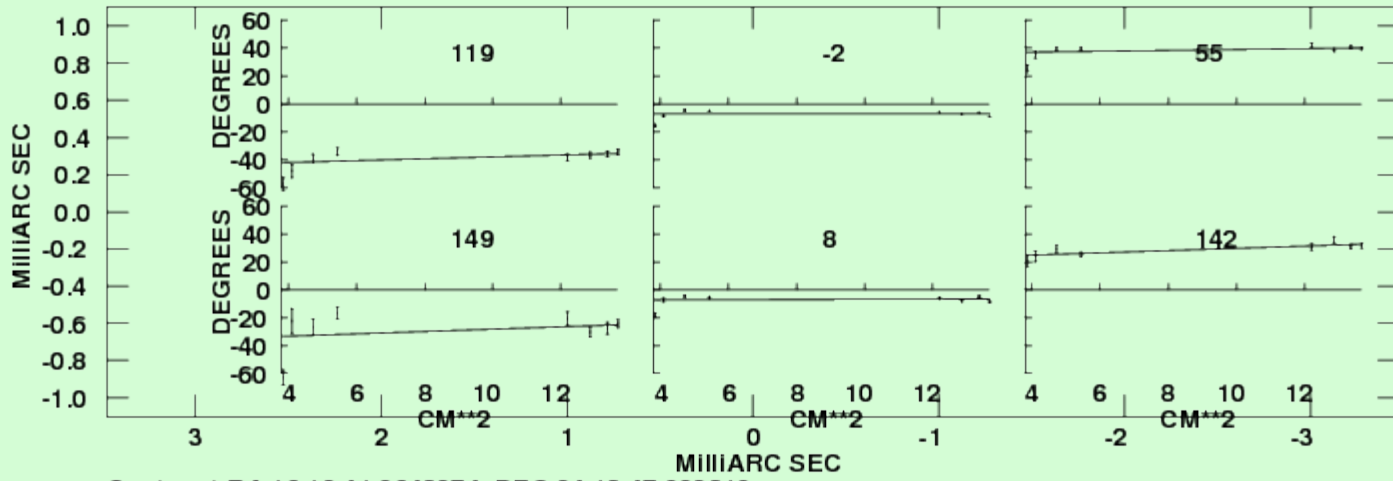
RM



8.4 GHz Stokes I



PLot file version 11 created 27-APR-2010 10:59:49
1613+342 WAVSQ 8.000 PANG 1613+342.BCUE.1



Center at RA 16 13 41.0642374 DEC 34 12 47.903219

RM

8114 MHz

8209

8369

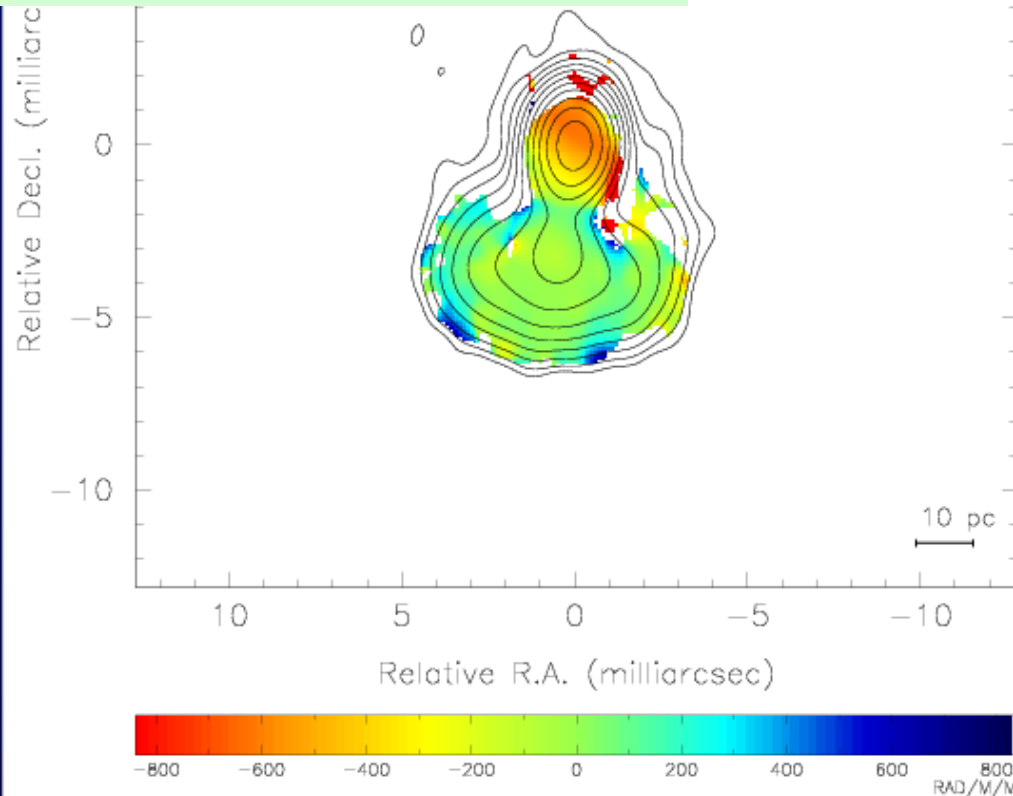
8594

12915

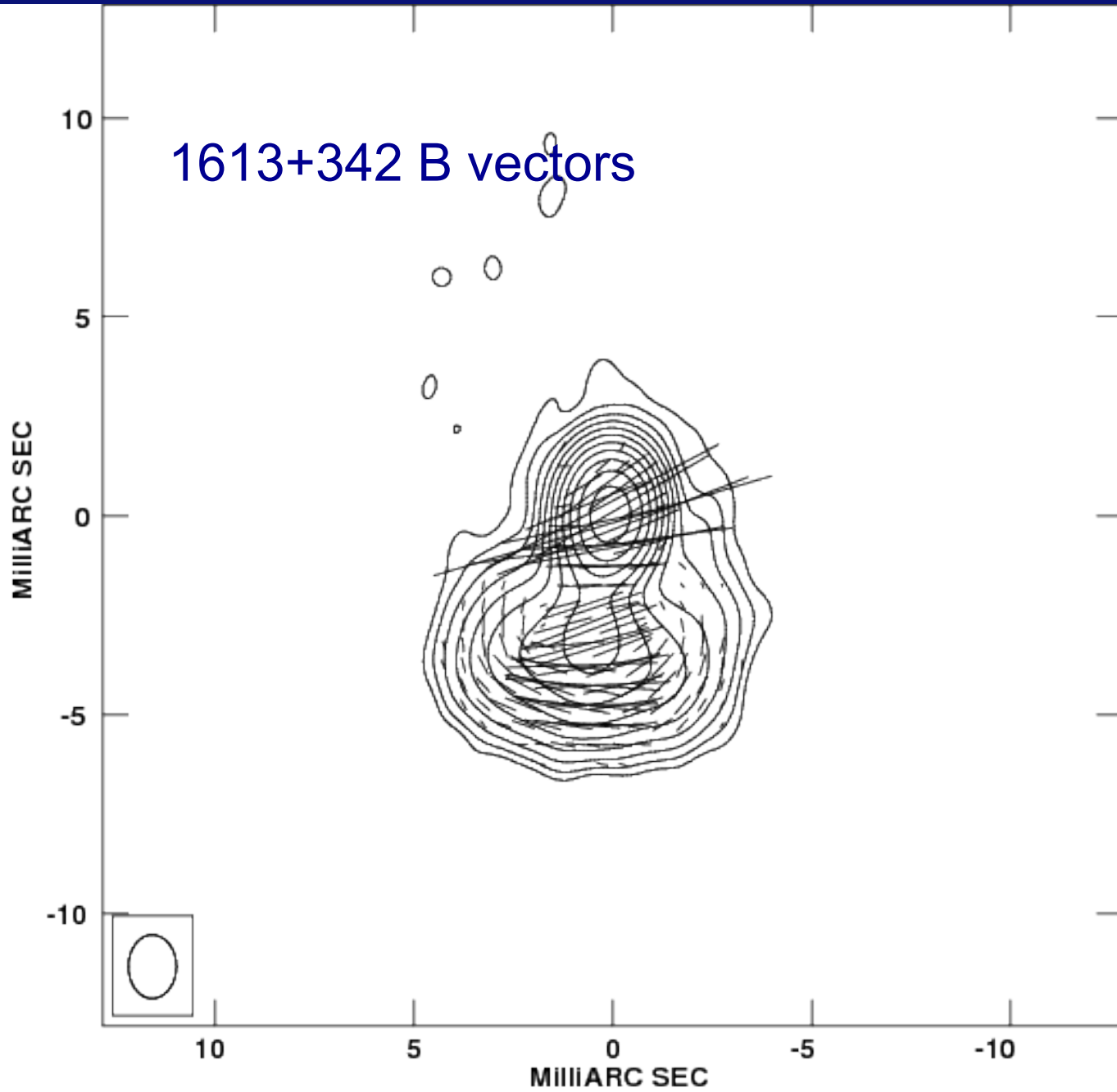
13885

14915

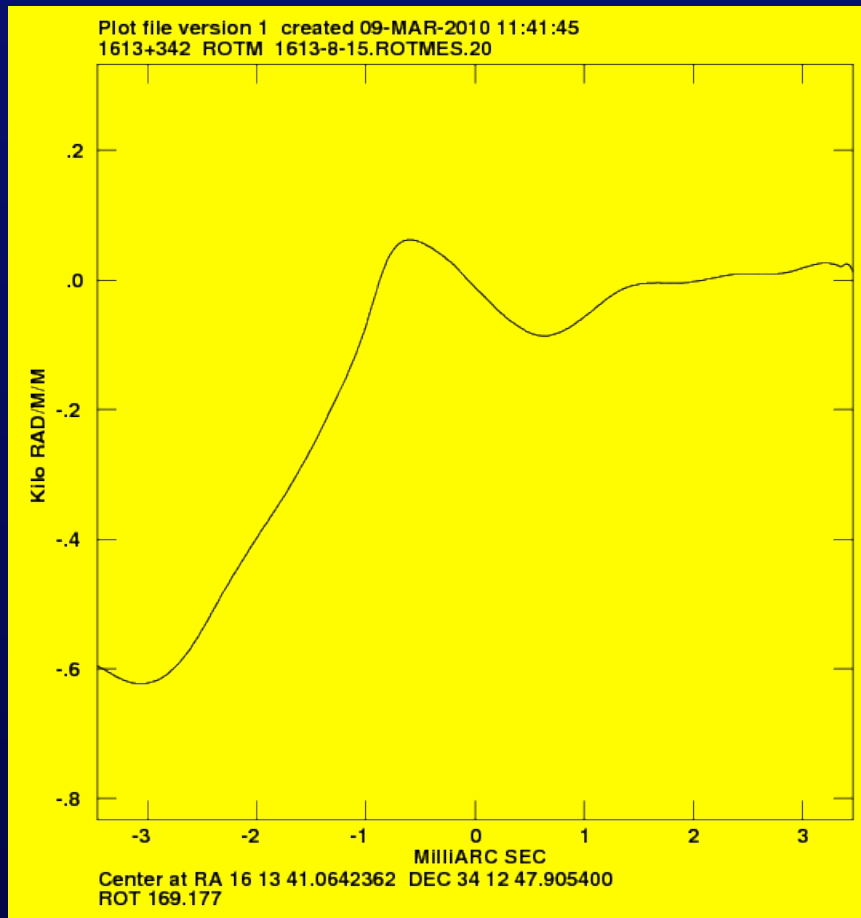
15391



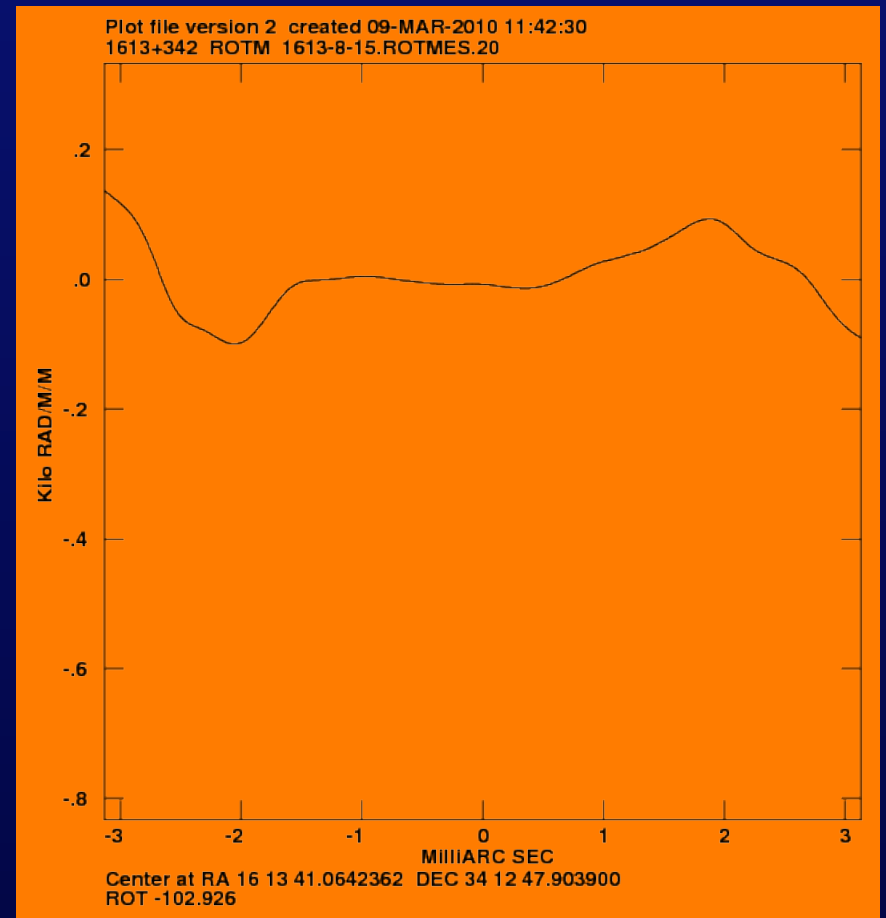
1613+342 B vectors



RM slices

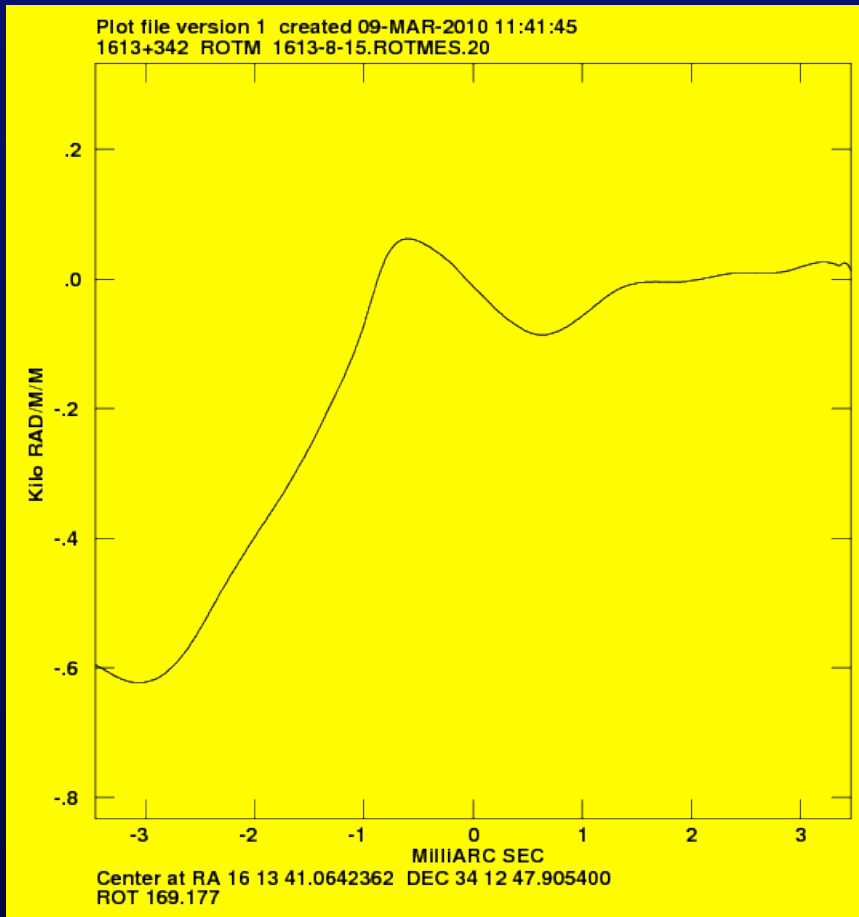


Along the jet

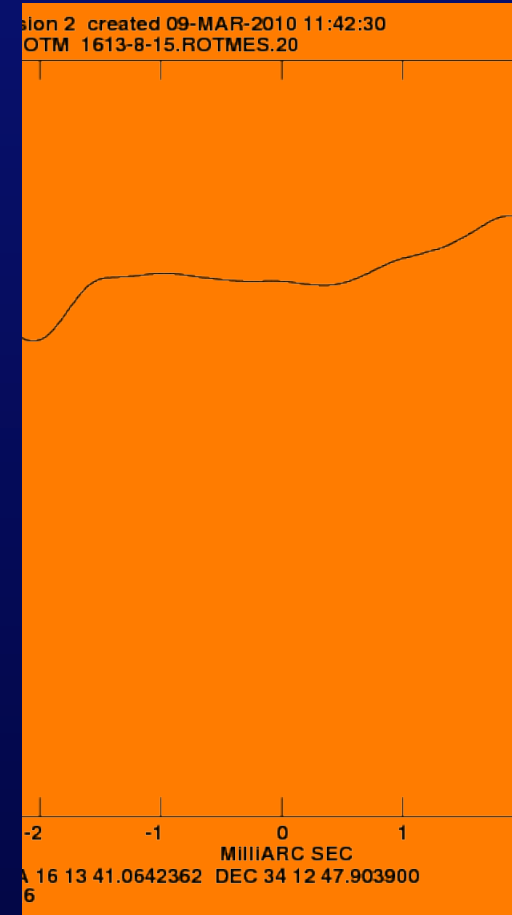


Across the jet

RM slices

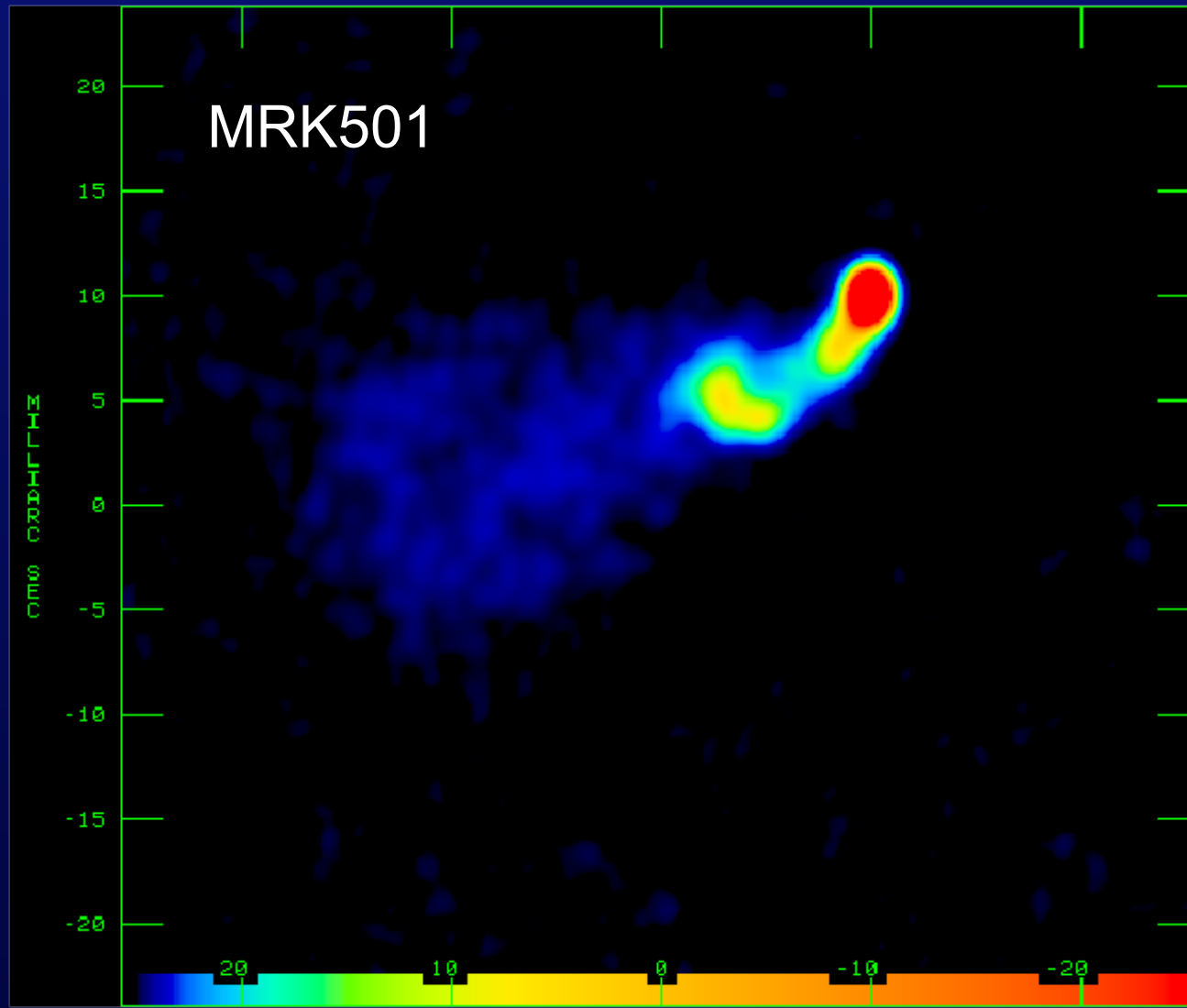


Along the jet

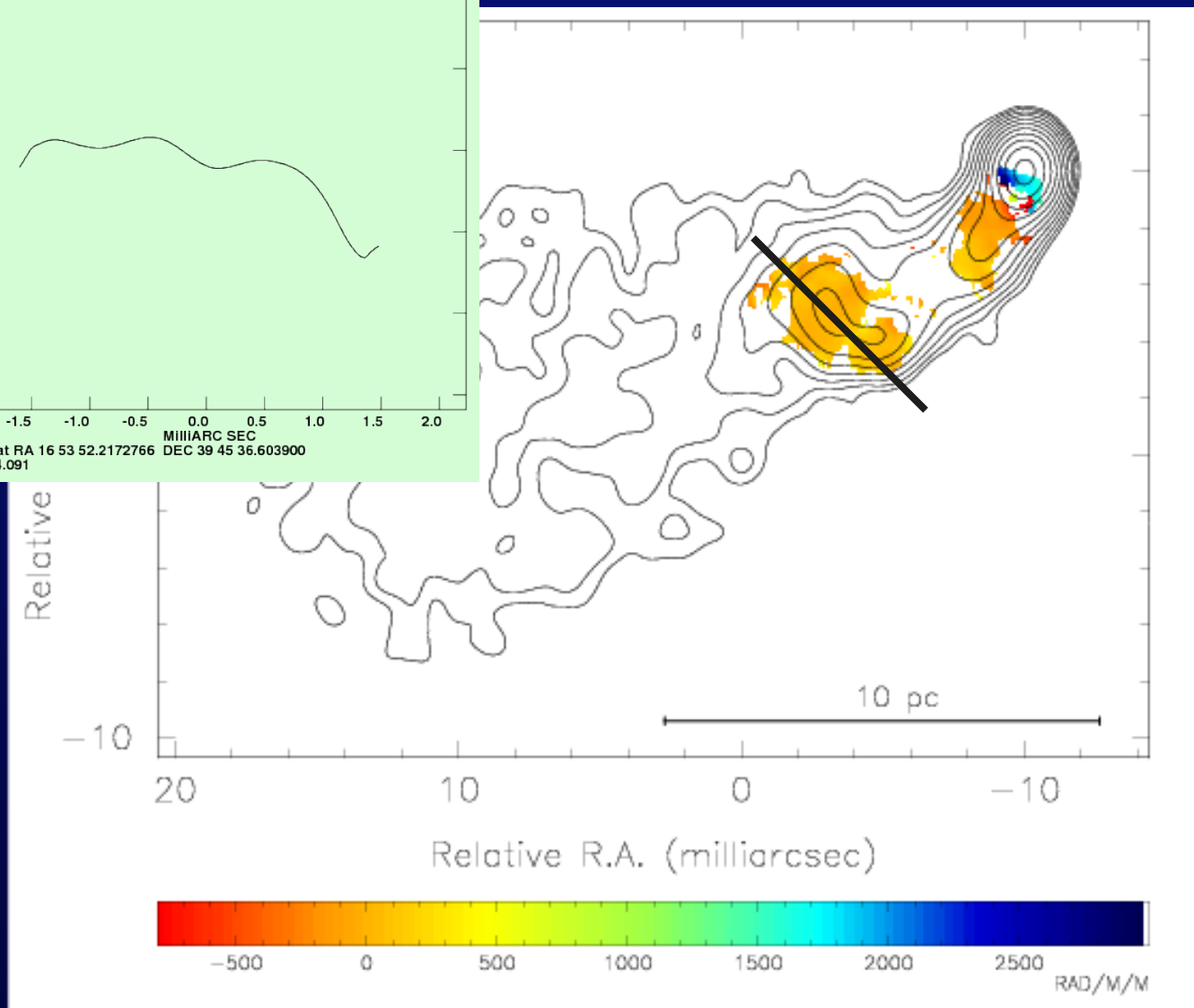
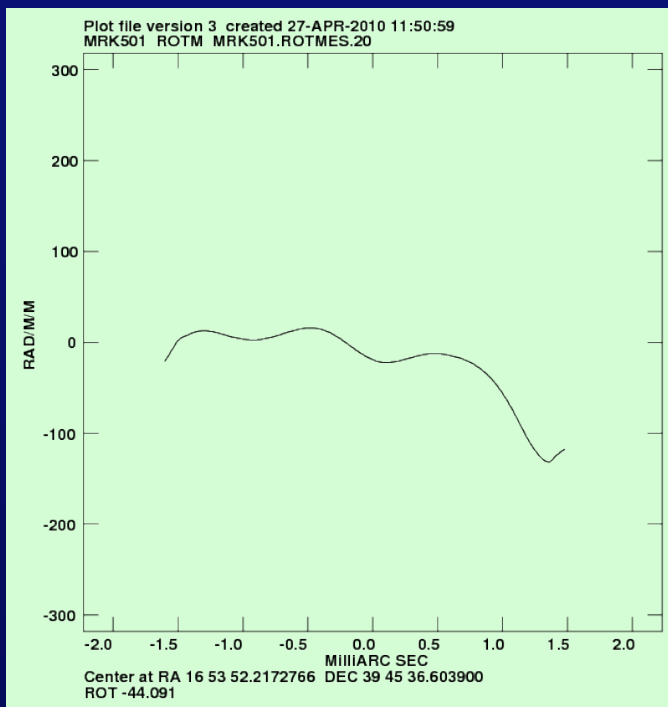


Across the jet

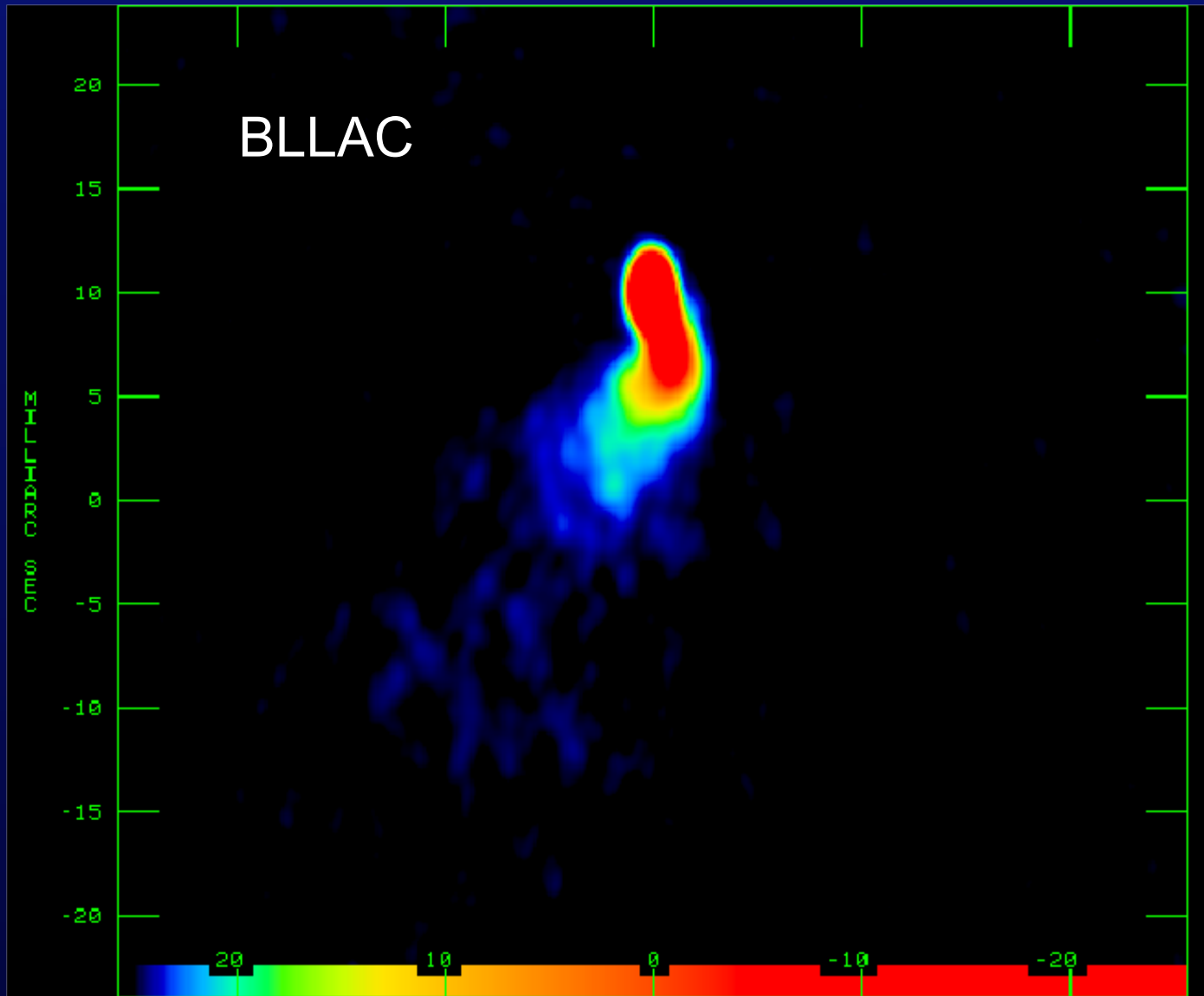
8.4 GHz Stokes I



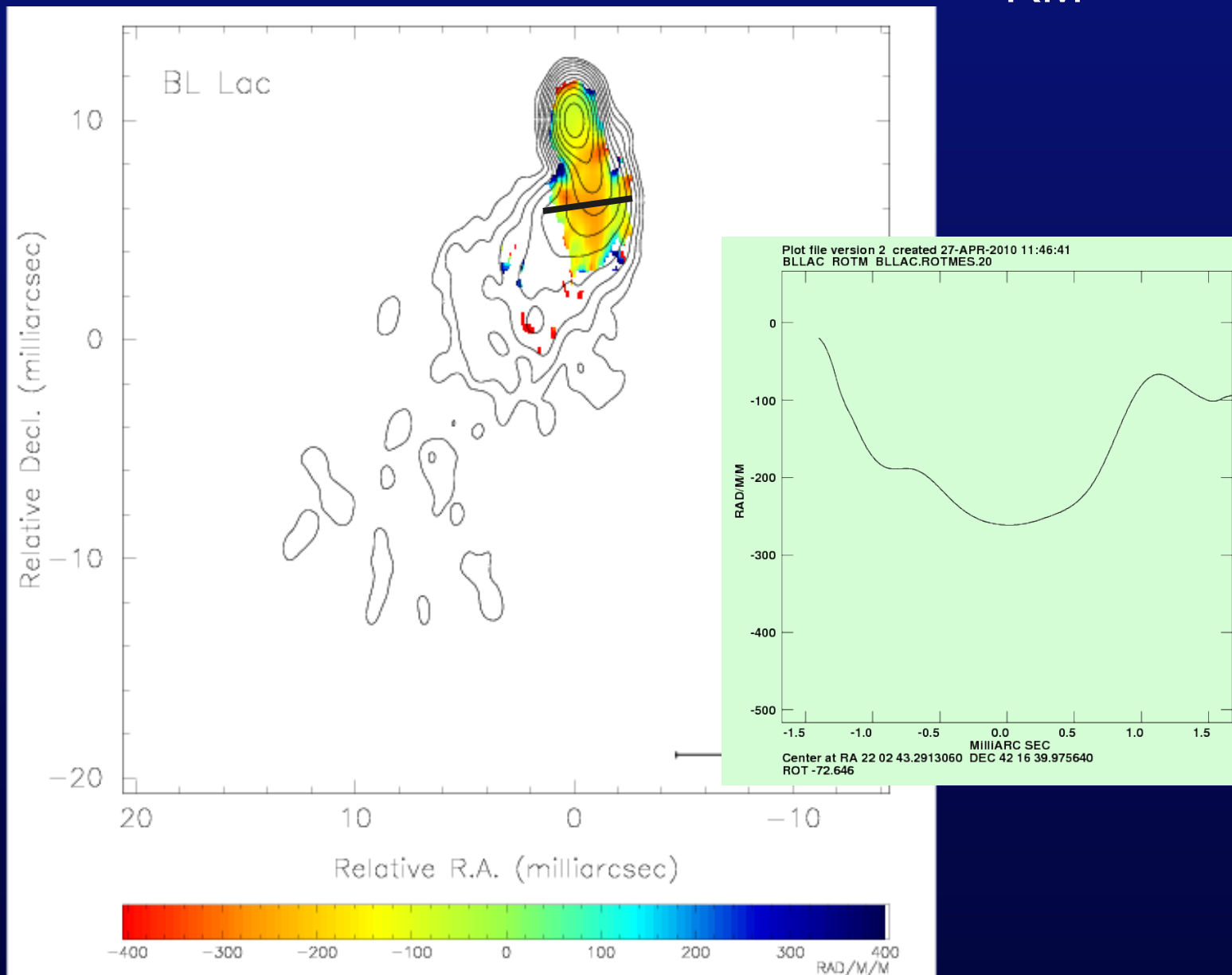
RM



8.4 GHz Stokes I

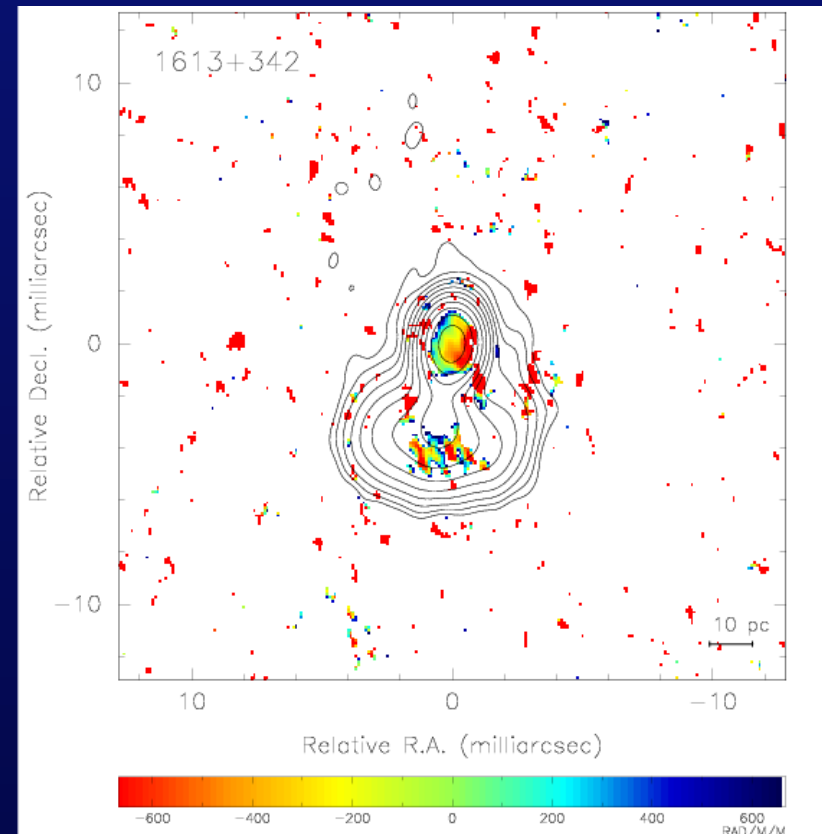


RM

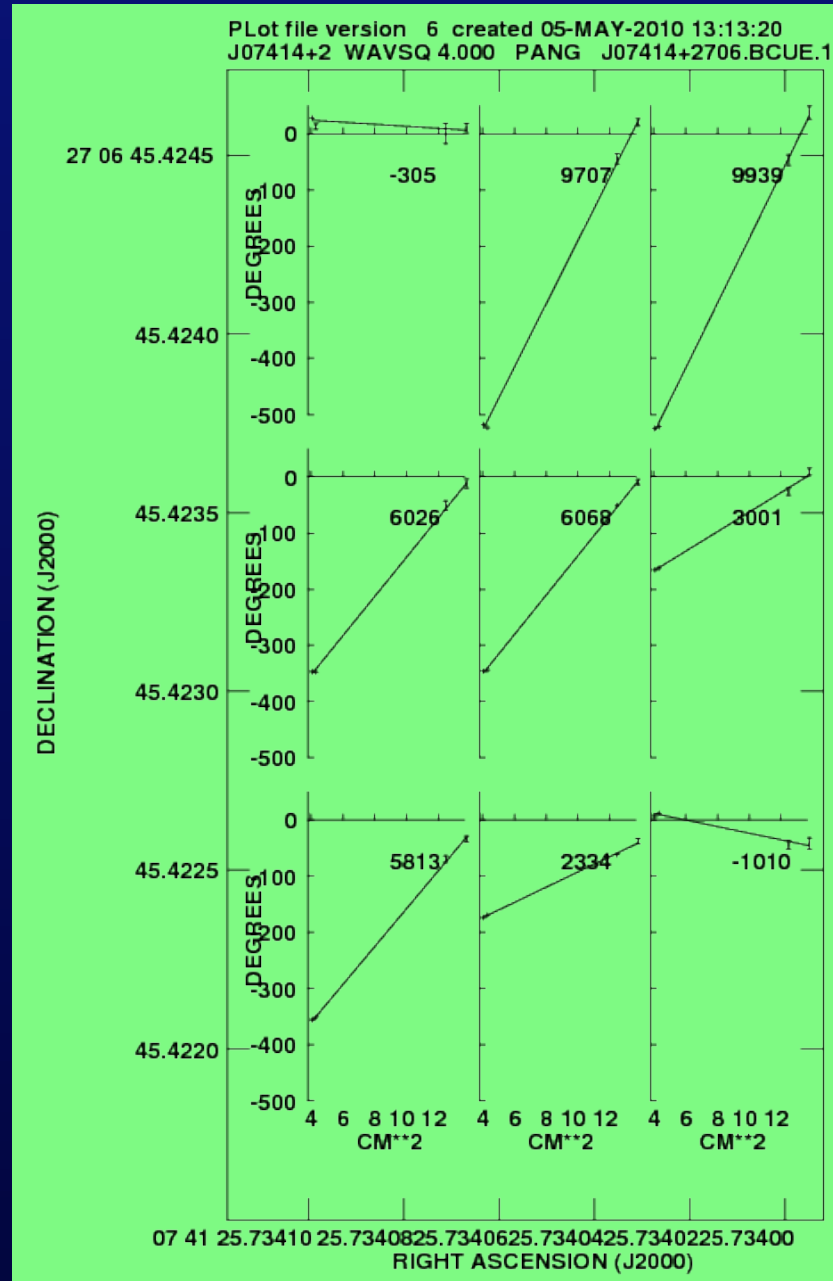
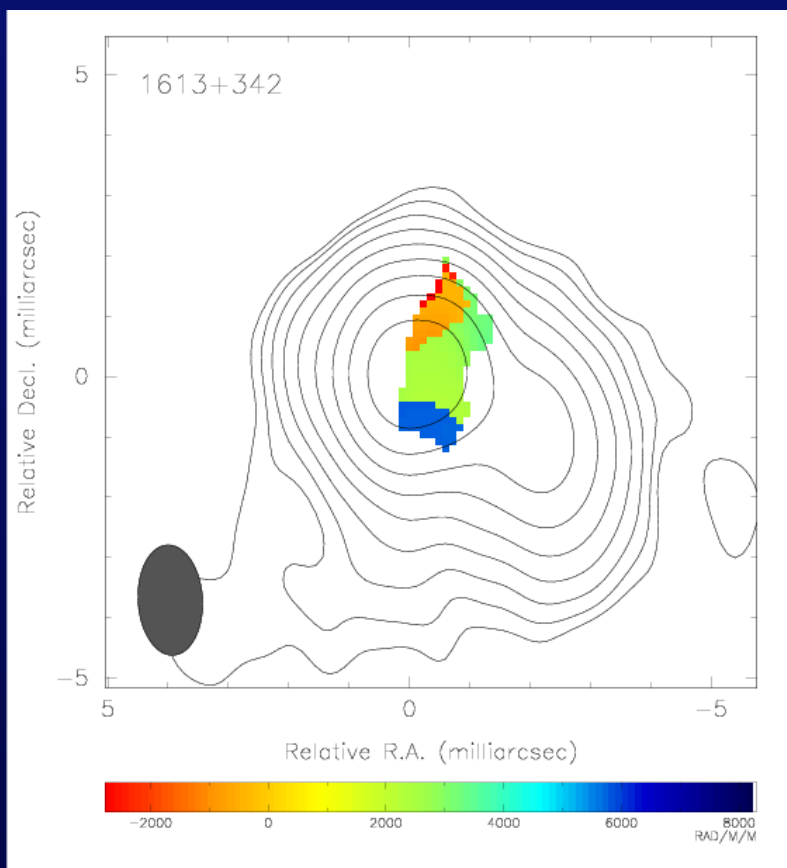


Bad things that can happen ...

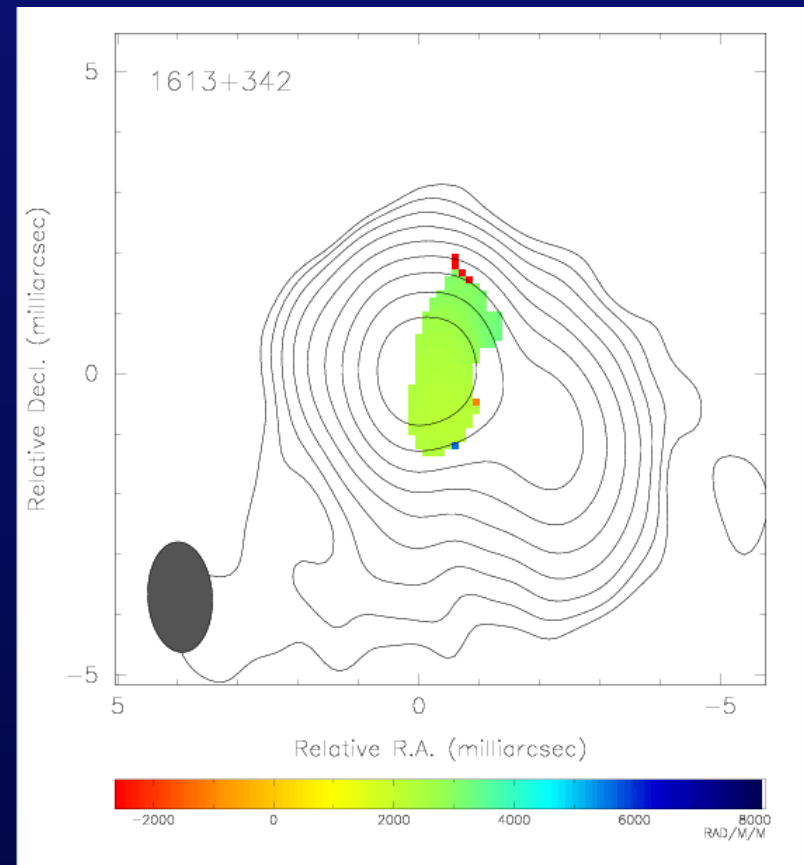
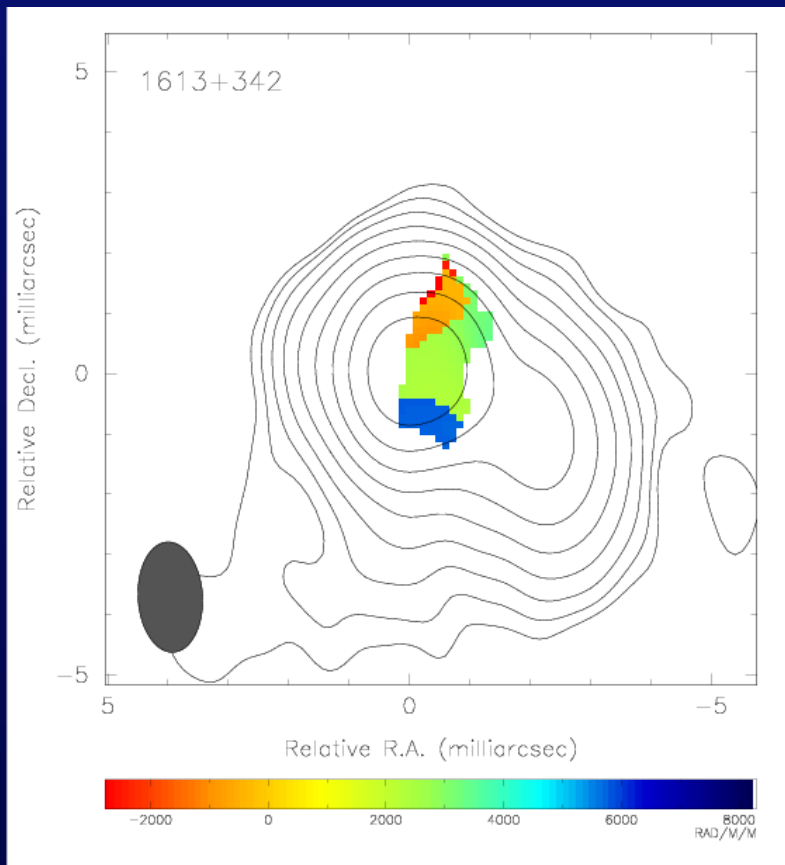
- ✧ Poor initial calibration
- ✧ Poor imaging choices
- ✧ Bookkeeping errors
- ✧ Poor coverage in wavelength-squared space
- ✧ everything else



Poor coverage in λ^2



Poor coverage in λ^2



Conclusions

- ✧ No conclusive evidence yet for strong RM gradients as a result of a helical magnetic field
- ✧ Need a large survey (e.g., VIPs) multi-freq polarimetry
- ✧ Use latest techniques (this conference)
- ✧ Look for weak gradients (like weak lensing) suggested by Blandford
- ✧ recruit more students ...