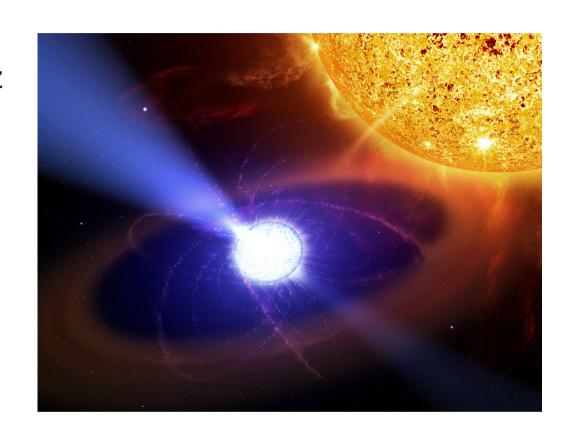
Single Station LOFAR Processing

Tatiana Niembro Hernandez
Charlotte Sobey
Leonardo Epifani
Ioannis Myserlis
Victor H De la Luz
David Mulcahy
Ewan Barr
Philippe-A. Bourdin

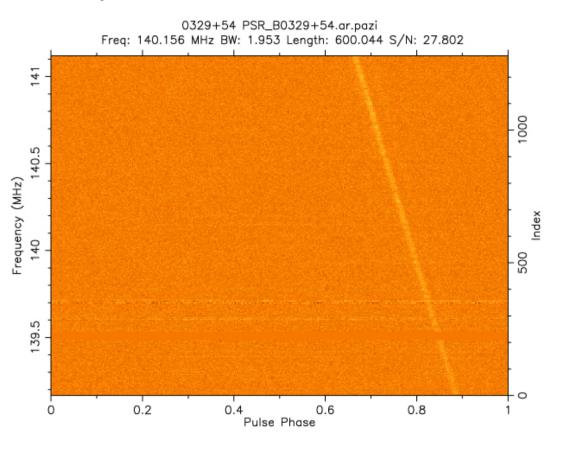


<u>Tutors:</u> Aris Noutsos, James Anderson, Masaya Kuniyoshi

Outline

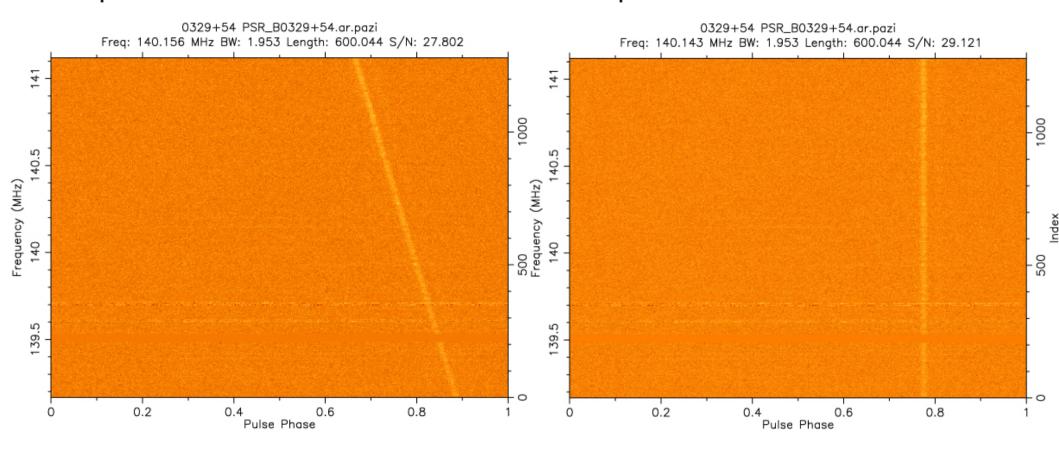
- 1) Dedispersion
- 2) Observing with LOFAR
- 3) Rotation Measures
- 4) Comparision with Literature

Dispersed:

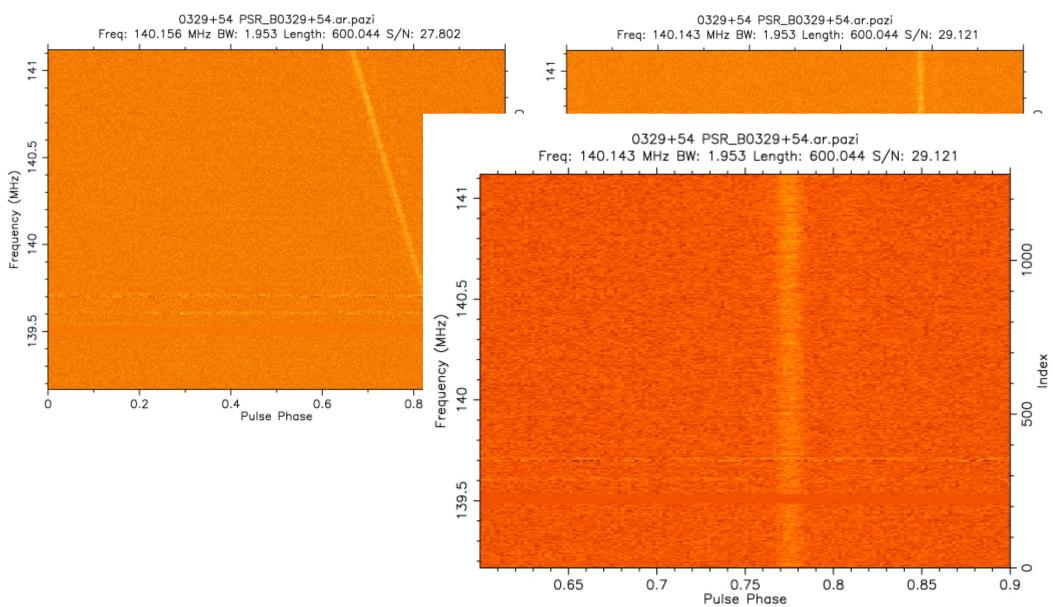


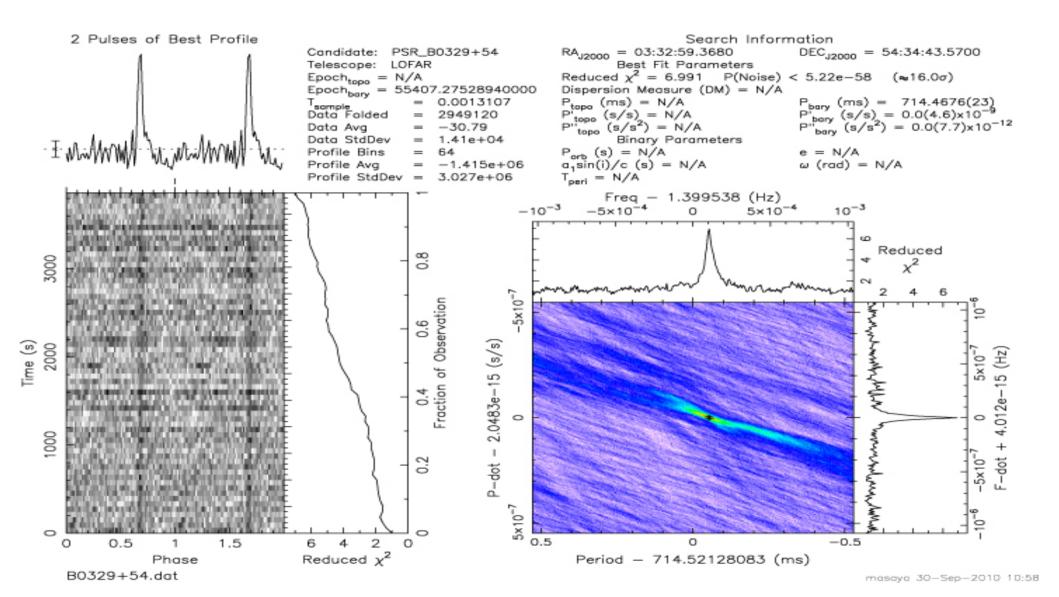
Dispersed:

De-dispersed:



Dispersed: De-dispersed:

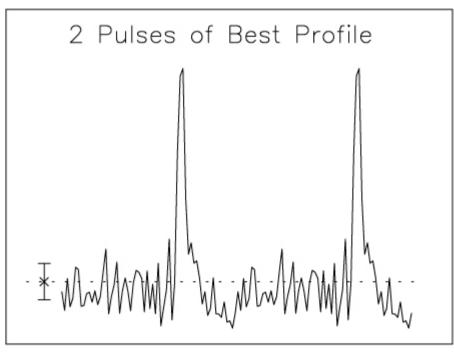




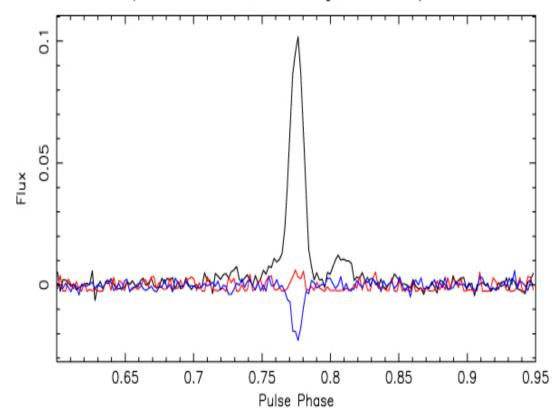
60 MHz (LBA, time series):

140 MHz (HBA, folded):

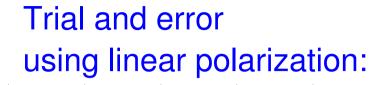
PSR B0329+54 @ 60 MHz (LOFAR LBA)

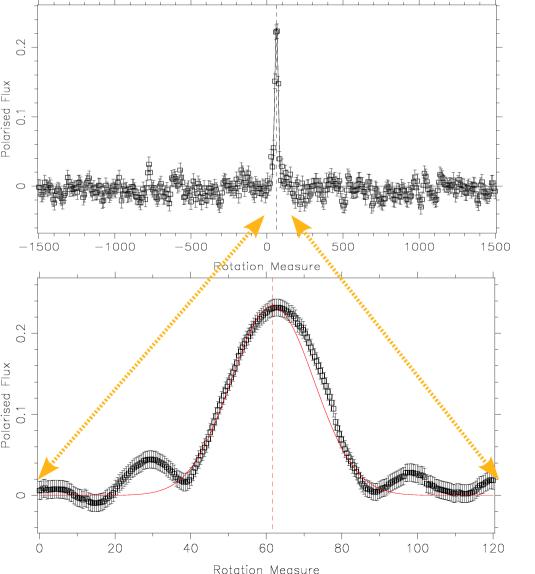


0329+54 PSR_B0329+54.ar.pazi Freq: 140.143 MHz BW: 1.953 Length: 600.044 S/N: 29.123

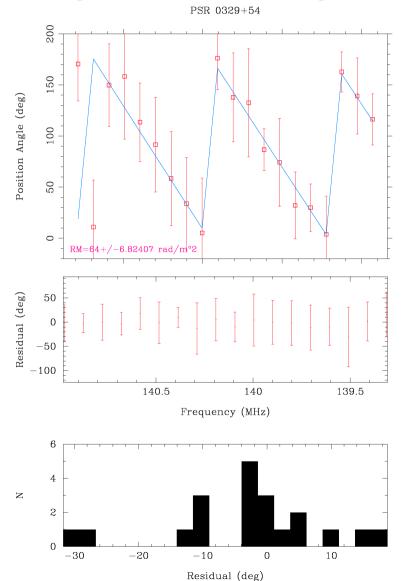


(black: flux, red: linear polarization, blue: circular polarization)

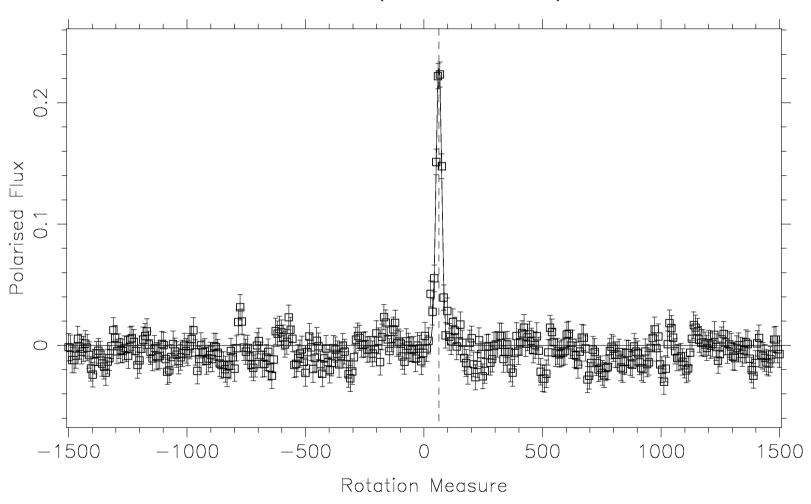




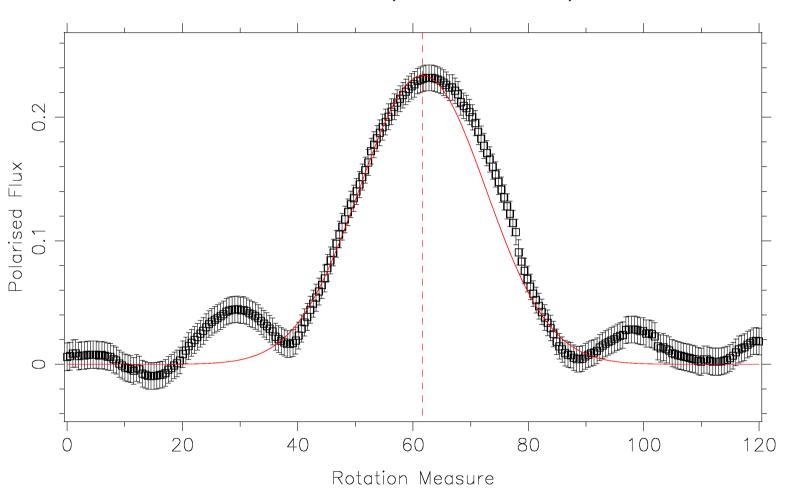
χ^2 fitting using Polarization Angle:



140 MHz (HBA, folded):



140 MHz (HBA, folded):

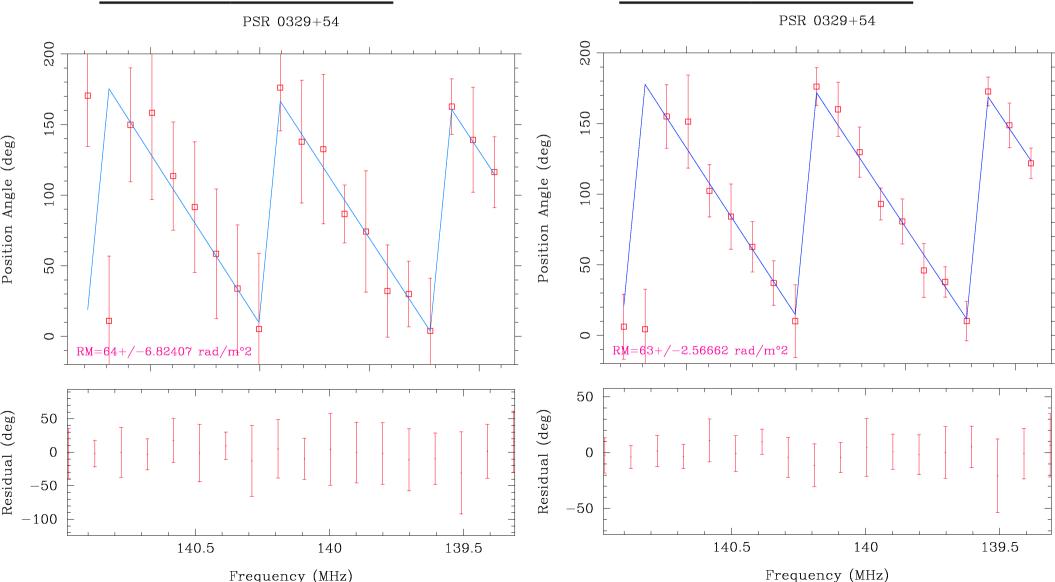


 χ^2 fitting using Polarization Angle:

[0.75, 0.82]

 $=> RM = 64 \pm 6.8 \text{ rad/m}^2$

[0.76 , 0.785]=> $RM = 63 \pm 2.6 \text{ rad/m}^2$



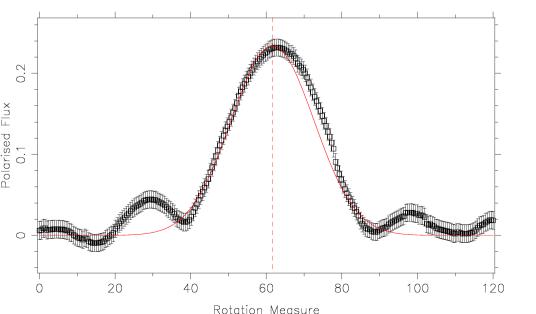
Trial and error using linear polarization:

Centre = 62.8

Width = 28.1

Height = 0.23

 $=> RM = 61.7 \pm 3.1 \text{ rad/m}^2$



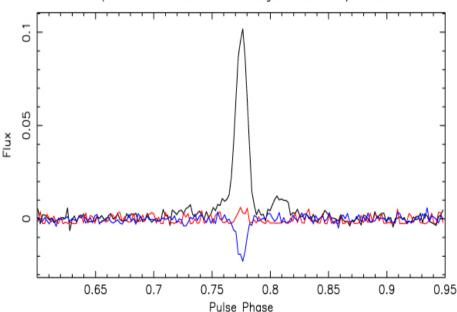
χ² fitting using Polarization Angle:

[0.75 , 0.82]=> RM = 64 ± 6.8 rad/m²

[0.76 , 0.785]

 $=> RM = 63 \pm 2.6 \text{ rad/m}^2$

0329+54 PSR_B0329+54.ar.pazi Freq: 140.143 MHz BW: 1.953 Length: 600.044 S/N: 29.123



Trial and error using linear polarization:

Centre = 62.8

Width = 28.1

Height = 0.23

 $=> RM = 61.7 \pm 3.1 \text{ rad/m}^2$

χ² fitting using Polarization Angle:

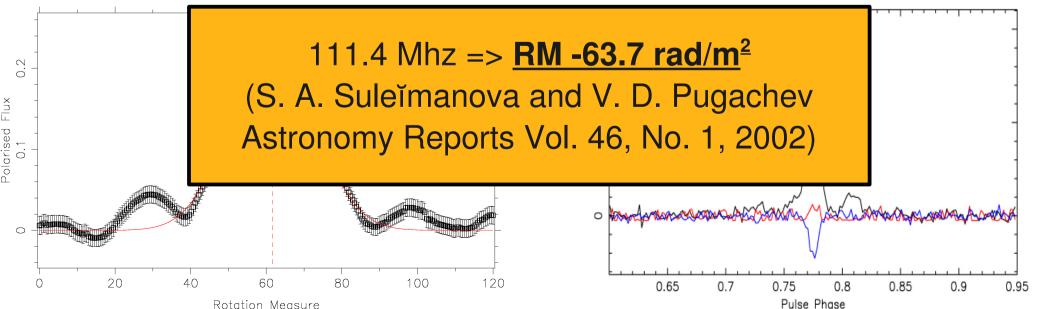
[0.75 , 0.82]

 $=> RM = 64 \pm 6.8 \text{ rad/m}^2$

[0.76, 0.785]

 $=> RM = 63 \pm 2.6 \text{ rad/m}^2$

0329+54 PSR_B0329+54.ar.pazi Freq: 140.143 MHz BW: 1.953 Length: 600.044 S/N: 29.123



B1919+21 in low frequencies

60-66 MHz band: Search Information $RA_{J2000} = 03:32:59.3680$ $DEC_{J2000} = 54:34:43.5700$ Candidate: PSR_B1919+21 Best Fit Parameters Telescope: LOFAR Reduced $\chi^2 = 13.296$ P(Noise) < 8.88e-136 (*24.8 σ) $Epoch_{topo} = N/A$ Dispersion Measure (DM) = N/A 55407.27528940000 P_{bary} (ms) = 1337.384(24) P'_{bary} (s/s) = 0.0(2.7)x10⁻⁷ P''_{bary} (s/s²) = 0.0(2.6)x10⁻⁹ P_{topo} (ms) = N/A Tsample 0.0013107 $P_{\text{topo}}^{\text{topo}}$ (s/s) = N/A $P_{\text{topo}}^{\text{topo}}$ (s/s²) = N/A Data Folded 524288 Data Avg -268.7Binary Parameters Data StdDev 8.512e+04 P_{orb} (s) = N/A Profile Bins e = N/A $a_1 \sin(i)/c$ (s) = N/A Profile Avg ω (rad) = N/A -2.894e+06 $T_{peri} = N/A$ Profile StdDev = 7.704e+06 Freq - 0.747774 (Hz) -5×10^{-3} 5×10⁻³ 900 ♀ Reduced 8 -5×10⁻⁵ Observation Time (s) 0.4 Fraction of (1.3482e-15 .5387 200 0.2 -dot -dot 2×10-5×10⁻⁵

10

5

Reduced χ^2

0.5

B1919+21.dat

Phase

1.5

15

-5

٥

Period - 1337.30290666 (ms)

-10

70-76 MHz band:

B1919+21.dat

Search Information $RA_{J2000} = 03:32:59.3680$ $DEC_{J2000} = 54:34:43.5700$ Candidate: PSR_B1919+21 Best Fit Parameters Telescope: LOFAR Reduced $\chi^2 = 24.827$ P(Noise) < 2.87e-285 (*36.1 σ) $Epoch_{topo} = N/A$ Dispersion Measure (DM) = N/A 55407.27528940000 P_{bary} (ms) = 1337.3897(34) P'_{bary} (s/s) = 0.0(6.7)x10⁻⁹ P''_{bary} (s/s²) = 0.0(1.1)x10⁻¹¹ P_{topo} (ms) = N/A 0.0013107 Tsample $P_{\text{topo}}^{\text{topo}}$ (s/s) = N/A $P_{\text{topo}}^{\text{topo}}$ (s/s²) = N/ Data Folded 2949120 topo (s/s²) = N/A Data Avg Binary Parameters Data StdDev 6425 P_{orb} (s) = N/A Profile Bins e = N/A $a_1 \sin(i)/c$ (s) = N/A Profile Avg ω (rad) = N/A -3.122e+06 $T_{peri} = N/A$ Profile StdDev = 1.379e+06 Freq - 0.747774 (Hz) -10^{-3} 10^{-3} -5×10⁻⁴ 5×10⁻⁴ Reduced 8 3000 0 10 0.4 0.6 Fraction of Observation 6 (s/s) Time (s) 2000 (HZ) 16 .3482e-15 .5387e-8 -5×10 F-dot P-dot 10-6 10 0.5 1.5 20 Reduced χ^2 Phase Period - 1337.30290666 (ms)

Conclusions

- Pulsars have been observed
- Found rotation measures
- Errors reduced by intelligent data selection
- Solar observation possible (in principle)
- FUN!!! (but also frustration == sometimes pure noise)