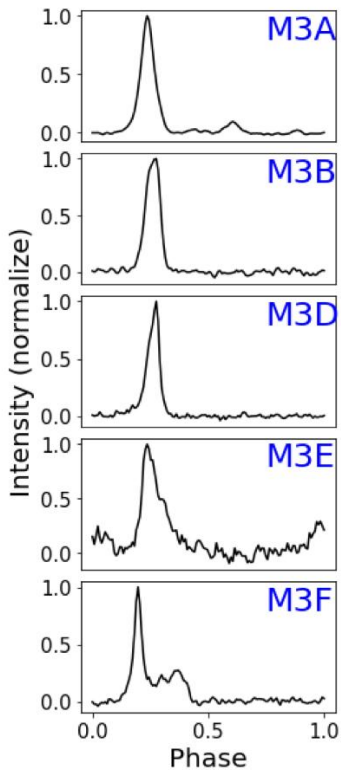
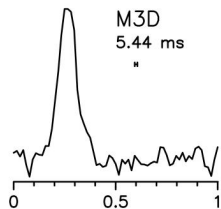
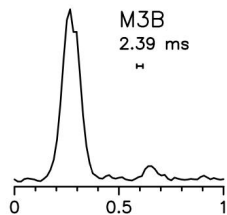
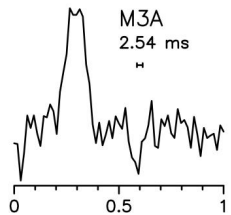


Measuring Polarization Properties of Pulsars in Globular Clusters with FAST

报告人：刘通
潘之辰、王琳
2024.7 昆明

Pulsars profiles in globular clusters (GCs)



beautiful pulsar profiles
based on FAST's
high sensitivity

but...

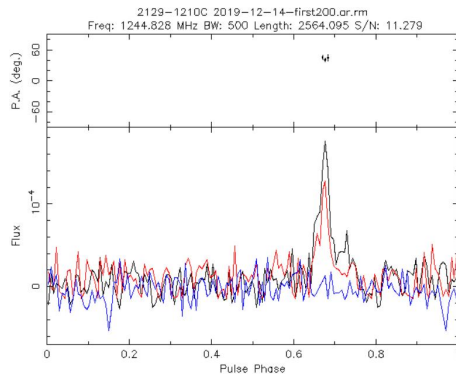
**lacking polarization
profiles**



M3 – 4+2 psr Li+



Why measuring polarization profiles?



Polarization profile of M13C
Wu et al. 2023

FAST pulsar database: I. Polarization profiles of 682 pulsars

P. F. Wang^{1,2}, J. L. Han^{1,2}, J. Xu^{1,2}, C. Wang^{1,2}, Y. Yan^{1,2}, W. C. Jing^{1,2}, W. Q. Su^{1,2}, D. J. Zhou^{1,2}, and T. Wang^{1,2}

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Abstract Pulsar polarization profiles are very basic database for understanding the emission processes in pulsar magnetosphere. After careful polarization calibration of the 19-beam L-band receiver and verification of beam-offset observation results, we obtain polarization profiles of 682 pulsars from observations by the Five-hundred-meter Aperture Spherical radio Telescope (FAST) during the survey tests for the Galactic Plan Pulsar Snapshot (GPPS) survey and other normal FAST projects. Among them, polarization profiles of about 460 pulsars are observed for the first time. The profiles exhibit diverse features. Some pulsars have a polarization position angle curve with a good S-shaped swing, and some with orthogonal modes; some have components with highly linearly components or strong circularly polarized components; some have a very wide profile, coming from an aligned rotator, and some have an interpulse from a perpendicular rotator; some wide profiles are caused by interstellar scattering. We derive geometry parameters for 190 pulsars from the S-shaped position angle curves or with orthogonal modes. We find that the linear and circular polarization or the widths of pulse profiles have various frequency dependencies. Pulsars with large fraction of linear polarization are more likely to have a large Edot .

- highly polarized
- studying faraday rotation measure
- studying magnetic structure

WHY GC PULSARS?

- highly concentrated
- an blank work

Polarization measurements of Arecibo-sky pulsars: Faraday rotations and emission-beam analyses

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Accepted 2023 July 5. Received 2023 June 20; in original form 2022 April 17

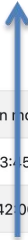
ABSTRACT

We present Faraday rotation measure (RM) values derived at L and P bands as well as some 60 Stokes parameter profiles, both determined from our long-standing Arecibo dual-frequency pulsar polarimetry programmes. Many of the RM measurements were carried out towards the inner Galaxy and the anticentre on pulsars with no previous determination, while others are remeasurements intended to confirm or improve the accuracy of existing values. Stokes-parameter profiles are displayed for the 58 pulsars for which no meaningful Stokes profile at lower frequency is available and 4 without a high-frequency pair. This is a population that includes many distant pulsars in the inner Galaxy. A number of these polarized pulse profiles exhibit clear interstellar-scattering tails; none the less, we have attempted to interpret the associated emission-beam structures and to provide morphological classifications and geometrical models where possible.

Key words: polarization – pulsars: general – ISM: magnetic fields – Galaxy: structure.

Measuring polarization profiles with FAST - observation

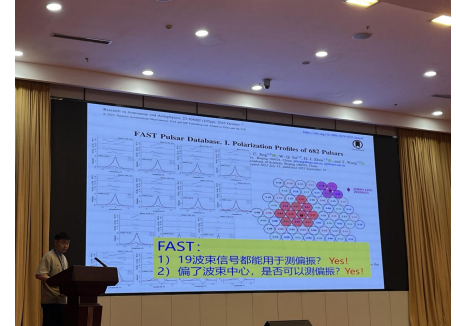
noise mode:
modulate



Details

2023/04/23 01:12:00 - 2023/04/23 02:42:00	SwiftCalibration mode observe M13			
	01:12:00 - 01:13:45 Inject Noise			
	01:13:45 - 02:42:00 Turn Off Noise			
Noise Requirement	Noise Mode: modulate	Noise Intensity: high		
	Noise Period: 0.2	Delay = 0	On = 25165824	Off = 25165824
Gain Settings	rfgain = 17.0 dB	dgain = 600.0		
feed_cabin_position_file: Yes	rotation_angle_file: Yes			

Backend	Sampling Time	Beam	Pol
psr	acclen = 5	M01	4pol



lecture by Zhou Dejiang,
SPSS 2024

4 channels of
polarization

Measuring polarization profiles with FAST - observation

NGC6402	NGC6402	NGC 6402	M 14	17:37:36.10	-03:14:45.3	264.4004167	-3.245916667					
NGC6402	观测日期	源名	赤经	赤纬	后端	观测模式	观测时长	noise mode	noise peirod	Pol		
NGC6402	2024/3/15	M14	17:37:36	-03:14:45.3	psr	SwiftCalibration	6908		undisclosed			
NGC6402	2024/1/24	M14	17:37:36	-03:14:45.3	psr	SwiftCalibration	6908		undisclosed			
NGC6402	2023/11/24	M14	17:37:36	-03:14:45.3	psr	SwiftCalibration	6908		undisclosed			
NGC6402	2023/7/4	M14	17:37:36	-03:14:45.3	psr	Tracking	7665		undisclosed			
NGC6402	2023/7/1	M14	17:37:36	-03:14:45.3	psr	Tracking	7140		undisclosed			
NGC6402	2023/6/15	M14	17:37:36	-03:14:45.3	psr	Tracking	7140		undisclosed			
NGC6402	2023/4/28	M14	17:37:36	-03:14:45.3	psr	Tracking	7100	-	-		2	
NGC6402	2023/4/23	M14	17:37:36	-03:14:45.3	psr	Tracking	7100	-	-		2	
NGC6402	2023/2/10	M14	17:37:36	-03:14:45.3	psr	Tracking	7100	-	-		2	
NGC6402	2022/11/16	M14	17:37:36	-03:14:45.3	psr	Tracking	7100	-	-		2	
NGC6402	2022/11/14	M14	17:37:36	-03:14:45.3	psr	Tracking	7100	-	-		2	
NGC6402	2022/11/12	M14	17:37:36	-03:14:45.3	psr	Tracking	7200	on	-		4	
NGC6402	2022/11/8	M14	17:37:36	-03:14:45.3	psr	Tracking	7200	on	-		4	
NGC6402	2022/11/4	M14	17:37:36	-03:14:45.3	psr	Tracking	10800	on	-		4	
NGC6402	2022/10/31	M14	17:37:36	-03:14:45.3	psr	Tracking	10800	on	-		4	
NGC6402	2022/4/28	source_146	17:37:38	-03:14:34.4	psr	SnapShot	1260	-	-		2	
NGC6402	2022/1/17	M14	17:37:36	-03:14:45.30	psr	Tracking	10800	-	-		2	
NGC6402	2021/12/6	M14	17:37:36	-03:14:45.30	psr	Tracking	7200	-	-		2	

FAST Proposal Coverage

NO: ---

Proposal Title:

Measuring polarization profiles and flux densities for all pulsars known in Globular Clusters within FAST sky

Scientific Category: (Please select a science category in which the experts you expect to review your proposal)

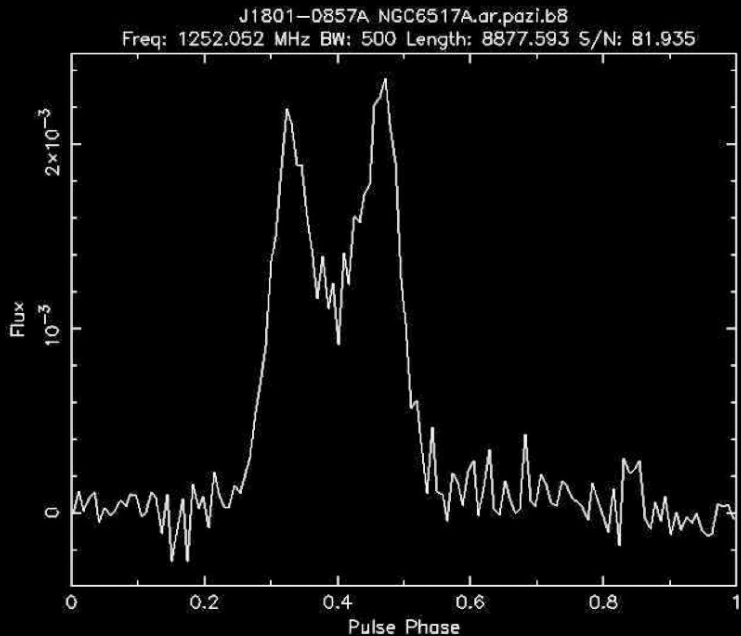
Pulsar Timing
 Pulsar Search
 Galactic Spec-line
 Extragalactic Spec-line
 FRB
 Continuum/Maser/Other

Proposal Abstract:

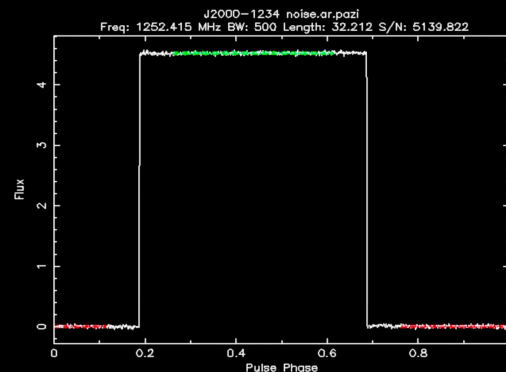
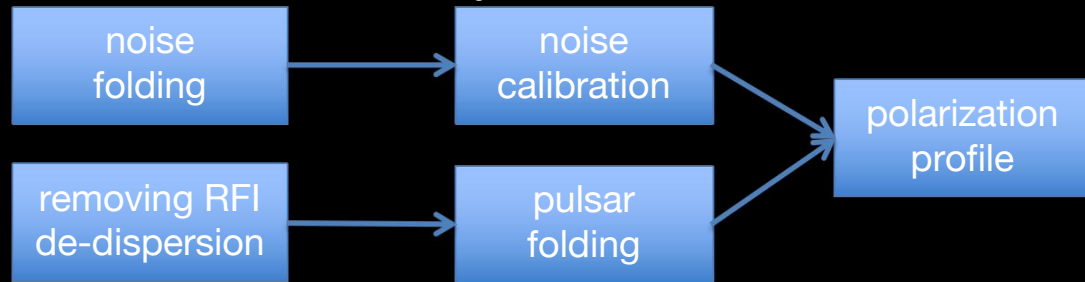
We propose to observe all known pulsars in 17 globular clusters within the FAST sky, with the aim of measuring their polarization profiles and flux densities. The measurement of these properties is a fundamental aspect of astrophysics, crucial for understanding various physical parameters such as radiation mechanisms and magnetic field distributions. We aim to establish a comprehensive database of basic pulsar parameters based on the unprecedented sensitivity of FAST, laying a solid foundation for subsequent research endeavors.

way more data required...**observation proposed!**

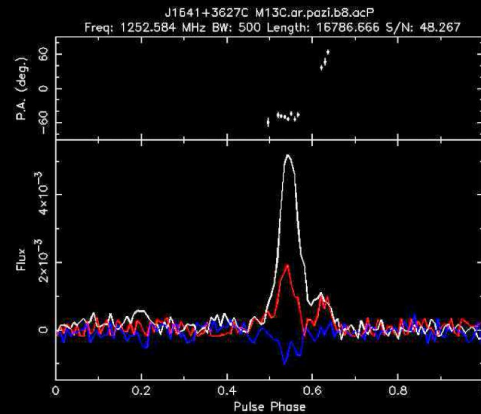
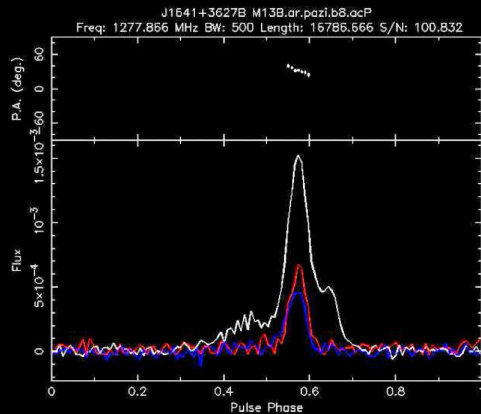
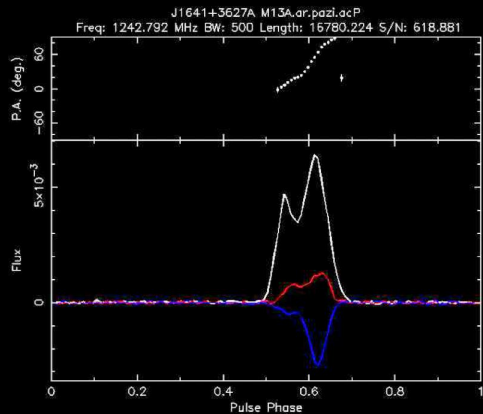
Measuring polarization profiles with FAST - data processing



as everyone know...



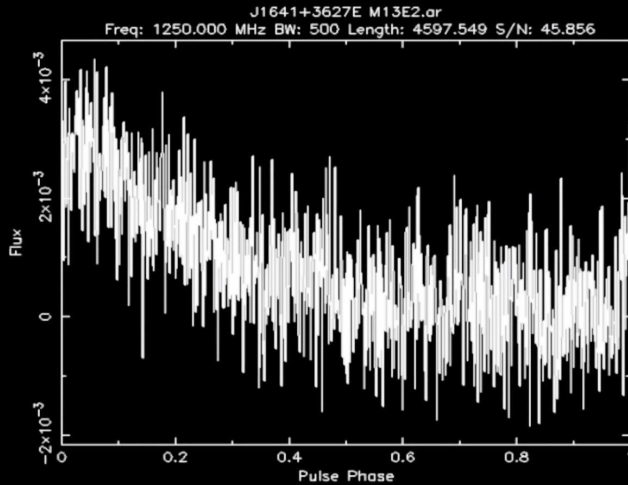
Preliminary results



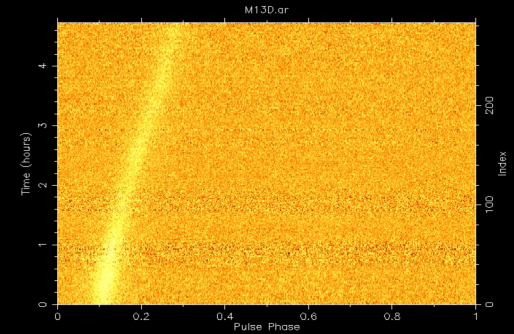
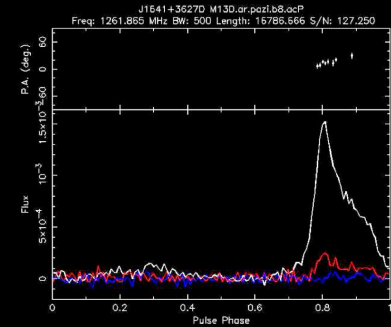
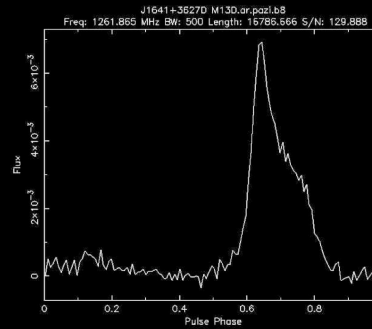
10 pulsars in 4 GCs processed
more to go

challenges

signal too weak



timing results of
high precision required



Goals

measuring all pulsars in GCs

build a database

measuring RMs

statistics analyse on profiles

**flux density measurements
(observation proposed!)**



FAST GC Discovery
Page

Goals - flux density measurements



1745-078 J2000 C 17h45m27.1040s -07d53'03.600" Dec00
 1742-078 B1950 C 17h42m44.0984s -07d51'54.118"

BAND	A	B	C	D	FLUX(Jy)	UVMIN(kL)	UVMAX(kL)
20cm	L	P	P	S	0.93		6
3.7cm	X	P	P	P	0.64		
0.7cm	Q	W	W	W	0.45		

nearby calibrator observation for
 globular by FAST - **THE BIG ZERO**

observation proposed!

VLA Calibrator

Source Name		RA	DEC	RA in deg	DEC in deg	Obs_Time	Pulsar Within?	Cal Name	Cal distance	Cal RA	Cal DEC	Cal FLUX(Jy) in
NGC6205	M 13	16:41:41.24	+36:27:35.5	250.4218333	36.45986111	6.04347074	✓	J1635+381	2.1	16:35:15.49	+38:08:04.50	1.90
NGC6218	M 12	16:47:14.18	-01:56:54.7	251.8090833	-1.948527778	3.976039186	✓	J1557-000	12.5	15:57:51.43	-00:01:50.41	1.00
NGC6229		16:46:58.79	+47:31:39.9	251.7449583	47.52775	5.694542505		J1727+455	7.2	17:27:27.65	+45:30:39.73	0.94
NGC6254	M 10	16:57:09.05	-04:06:01.1	254.2877083	-4.100305556	3.662918687	✓	J1743-038	11.7	17:43:58.85	-03:50:04.61	1.55
NGC6341	M 92	17:17:07.39	+43:08:09.4	259.2807917	43.13594444	5.906340569	✓	J1727+455	3.0	17:27:27.65	+45:30:39.73	0.94
NGC6366		17:27:44.24	-05:04:47.5	261.9343333	-5.079861111	3.507109746		J1743-038	4.2	17:43:58.85	-03:50:04.61	1.55
NGC6402	M 14	17:37:36.10	-03:14:45.3	264.4004167	-3.245916667	3.796300616	✓	J1743-038	1.7	17:43:58.85	-03:50:04.61	1.55
NGC6426		17:44:54.65	+03:10:12.5	266.2277083	3.170138889	4.583194267		J1737+063	3.7	17:37:13.72	+06:21:03.57	1.08
NGC6517		18:01:50.52	-08:57:31.6	270.4605	-8.958777778	2.743290011	✓	J1745-078	4.2	17:45:27.10	-07:53:03.60	0.93
NGC6535		18:03:50.51	-00:17:51.5	270.9604583	-0.297638889	4.195522506		J1743-038	6.1	17:43:58.85	-03:50:04.61	1.55

Measuring Polarization Properties of Pulsars in Globular Clusters with FAST

Thank You!

报告人：刘通
潘之辰、王琳
2024.7 昆明