

The Green Bank Northern Celestial Cap Survey

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GBNCC Collaboration

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GBNCC

- Overview of the survey
- Overview of the data analysis
- Current Status
- Overall Results
- Specific MSP results

GBNCC

- Plan to eventually cover entire GBT sky
 - Stage 1 - Entire Sky North of 38 deg in dec
 - Stage 2 - Rest of GBT Sky (dec > -46 deg)
- Began taking data in 2009, completed Stage 1 summer 2011
- Stage 2 began in 2012, is ongoing

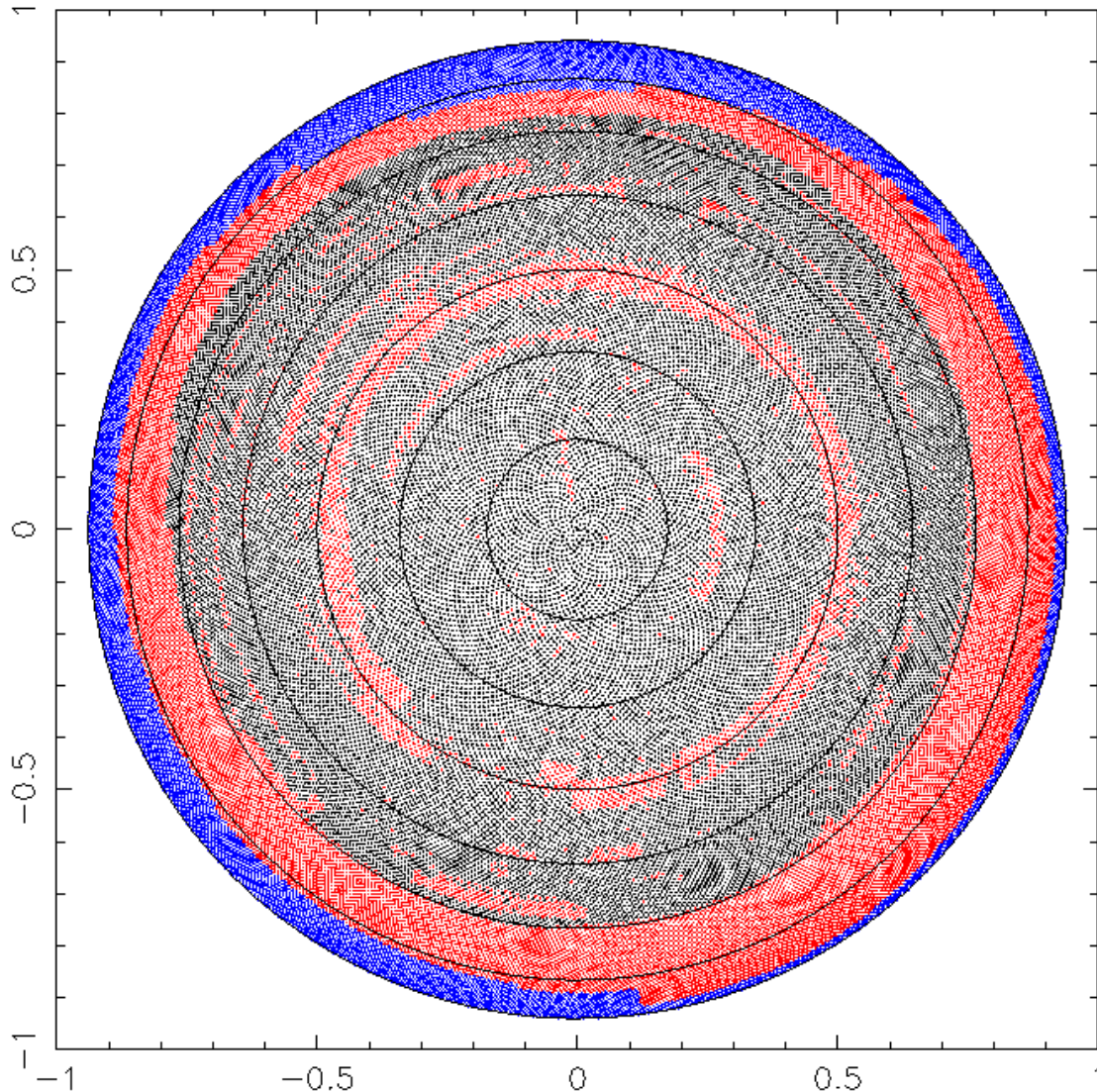
f_c	Δf	t_{samp}	n_{chan}	Δf_{chan}	T_{int}
350 MHz	100 MHz	81.92 μs	4096	~ 0.0244 MHz	120 s

Data Analysis

- Search DMs up to 500 pc/cm^3
- Excise RFI using standard techniques (rfifind,zapbirds)
- Data is searched using non-acceleration and acceleration search (accelsearch, zmax=50)
- Initial data analysis performed by targeting FERMI point sources from 1FGL catalog (1 MSP discovered, J1816+4510)
- Full data analysis began in early 2012
- Data processed using the CLUMEQ's Guillimin supercomputer (2048 cores for pulsar searching) and the Ranger and Lonestar clusters at the Texas Advanced Computing Center

<http://fermi.gsfc.nasa.gov/ssc/data/access/lat>

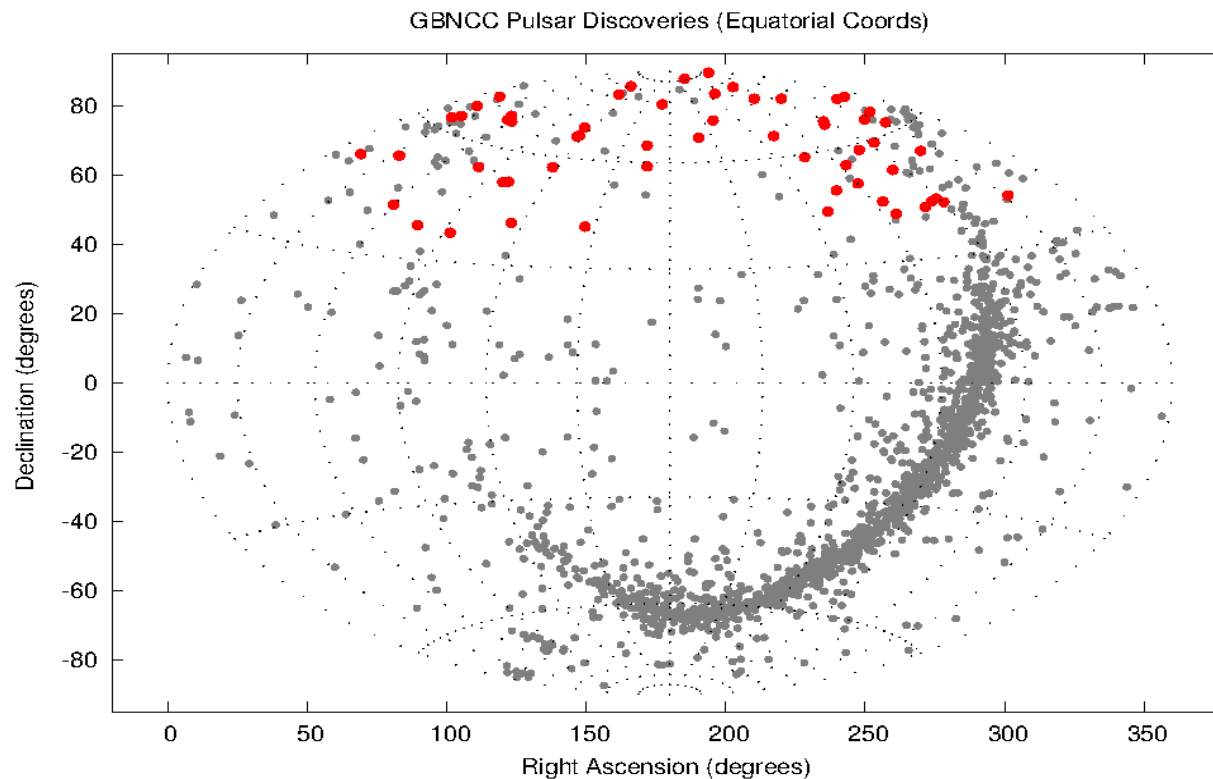
GBNCC Status



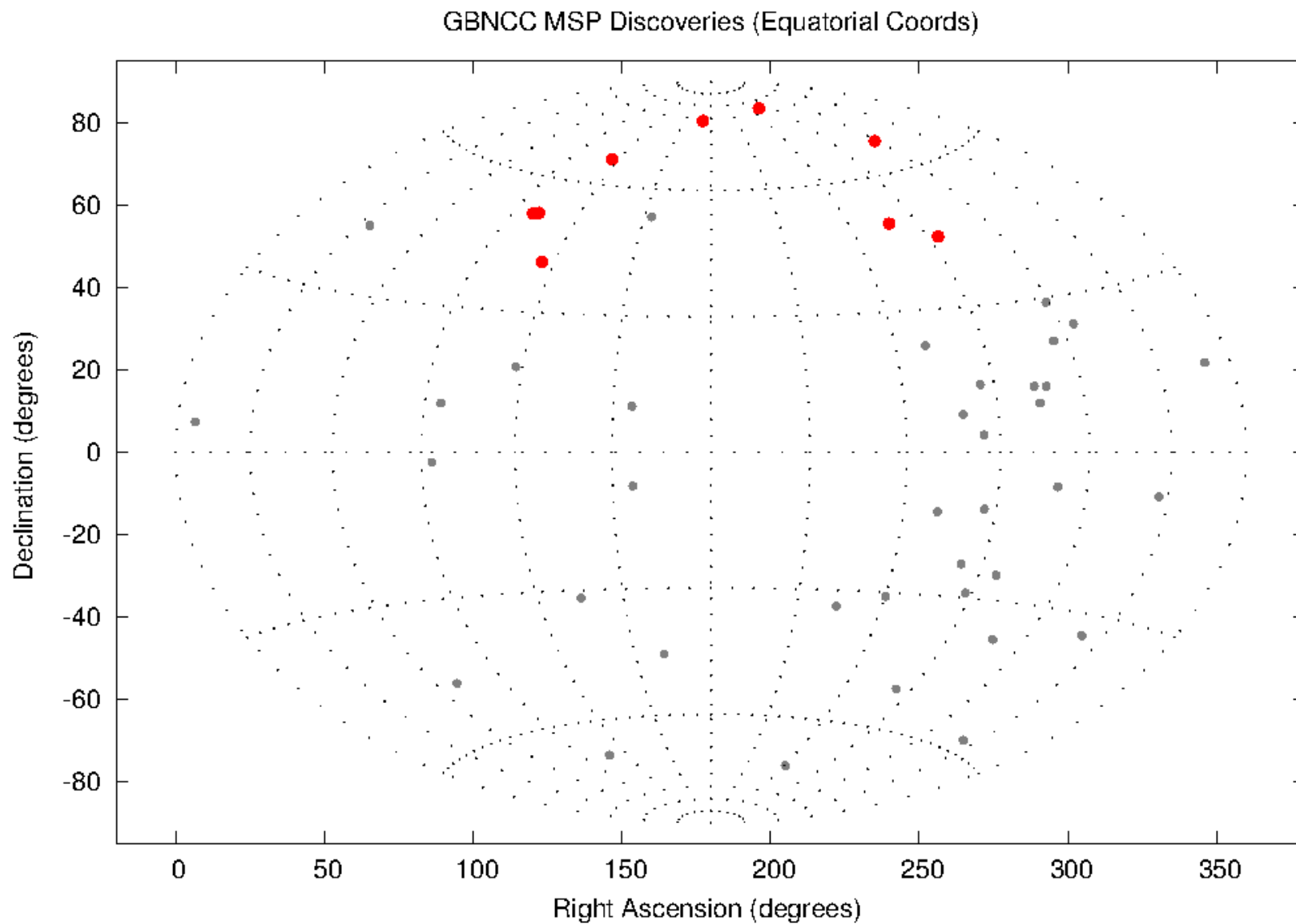
- Complete survey will require ~140,000 beams
- ~42,000 beams taken
- ~24,000 processed

GBNCC Results

- 59 Pulsars discovered
- 9 MSPs ($P < 10\text{ms}$) (2-4 potentially useful for PTAs)
- 5 partially recycled or young ($10\text{ms} < P < 100\text{ms}$)
- 6 known to be in binaries



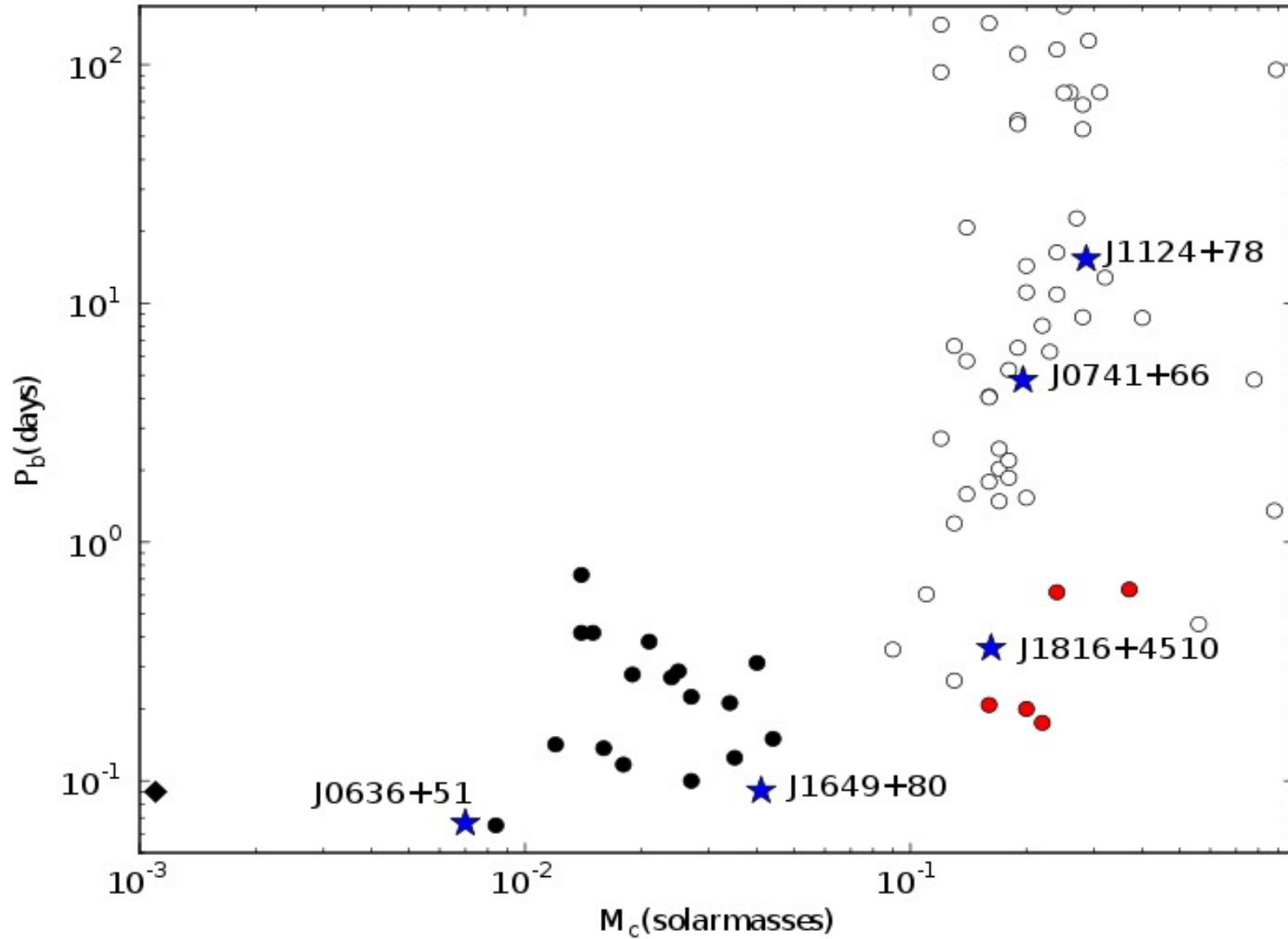
GBNCC Results



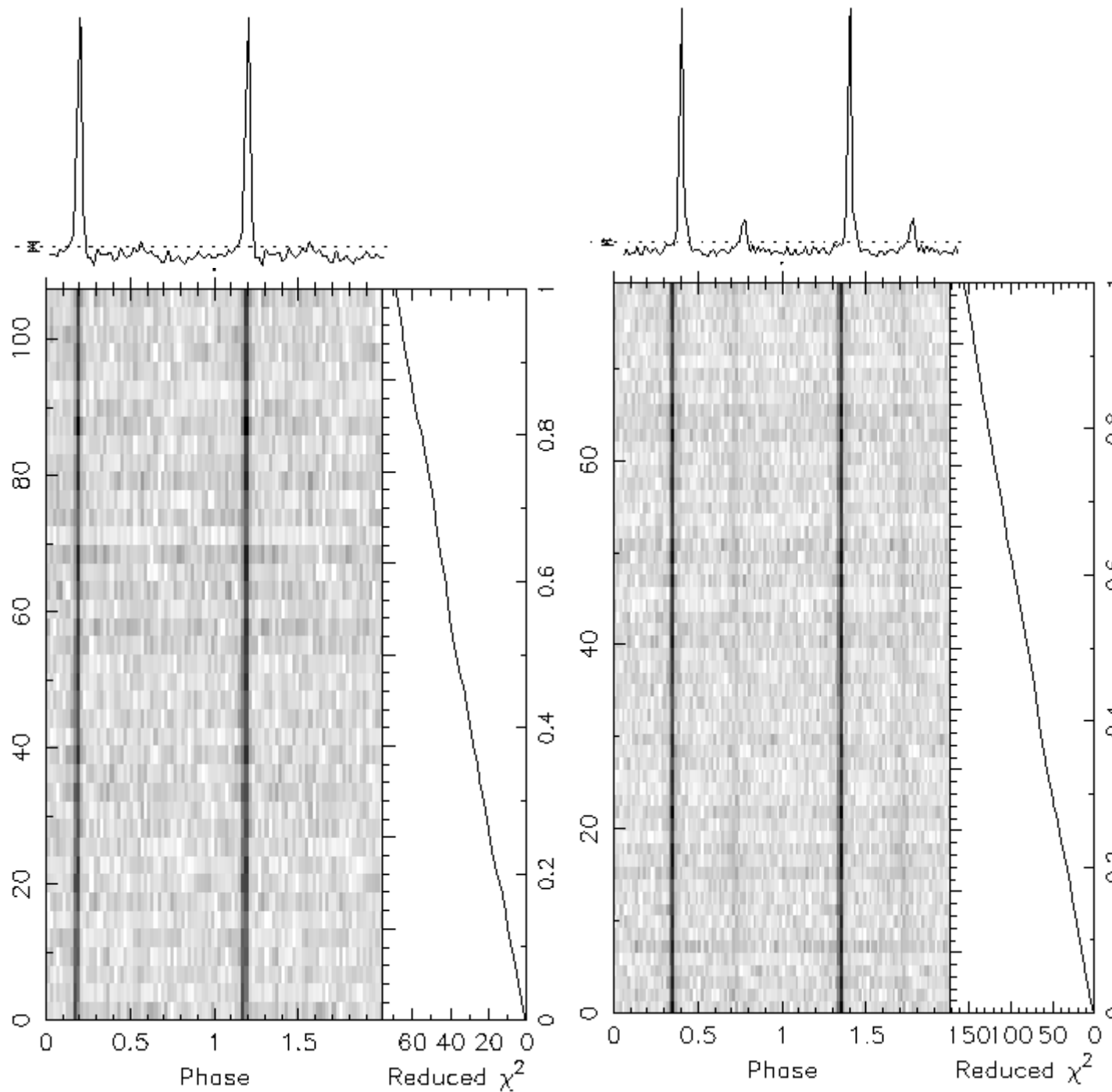
MSP Results

PSR	P_0 (ms)	$DM \frac{pc}{cm^3}$	D(kpc)	P_B (days)	a sin i
J0636+51	2.9	11	.5	0.066	0.009
J0645+51	8.9	18	.7	Isolated	
J0740+41	3.1	21	.7	Isolated	
J0741+66	2.9	15	.7	4.8	4.0
J1122+78	4.2	11	.6	15	12
J1649+80	2.0	31	1.6	0.091	0.06
J1710+49	3.2	7.1	.7	Isolated	
J1816+4510	3.2	36	2.4	0.36	0.60
J1953+67	8.6	57	3.4	Isolated	

MSP Results



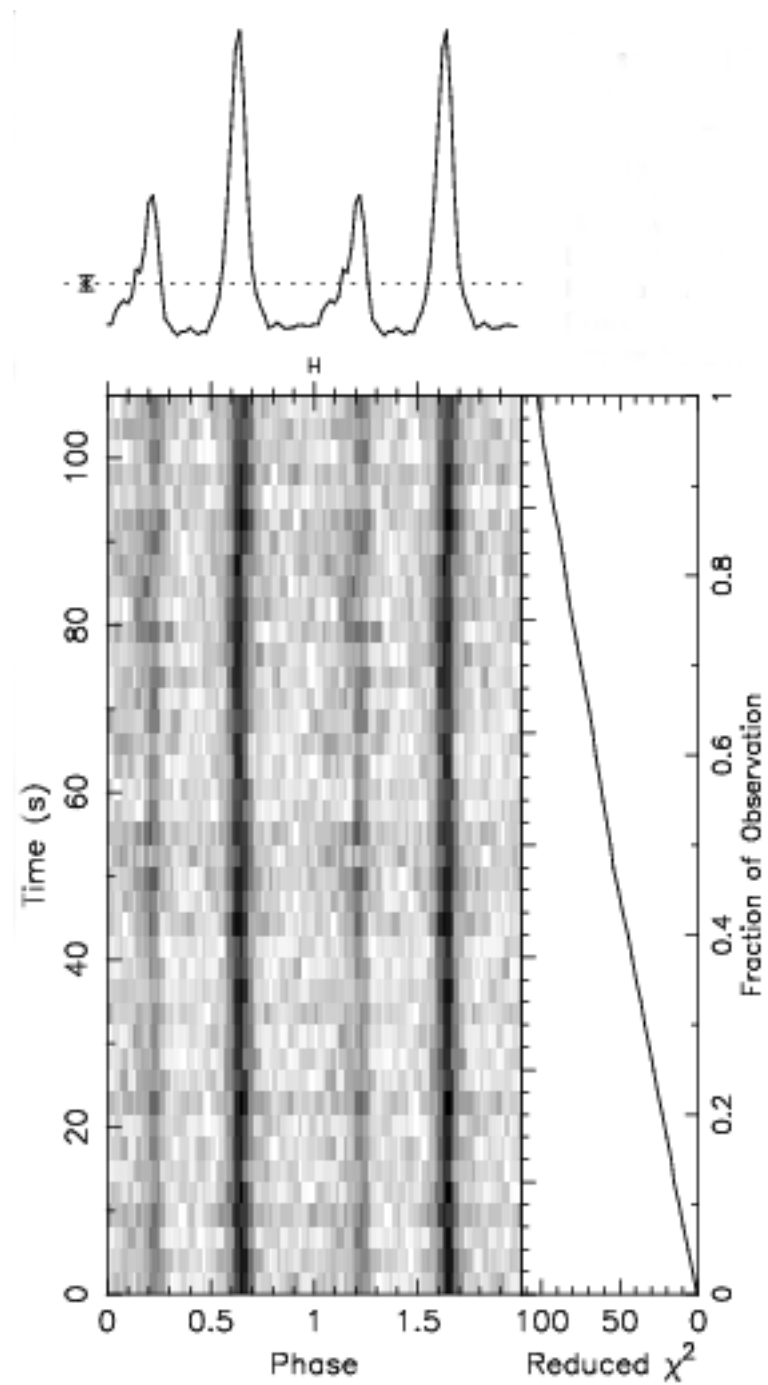
J0645+51



- Period: 8.85ms
- DM: 18.2
- Isolated
- Sub us TOA in less than 5 min at 820MHz
- Has been added to PTA timing programs

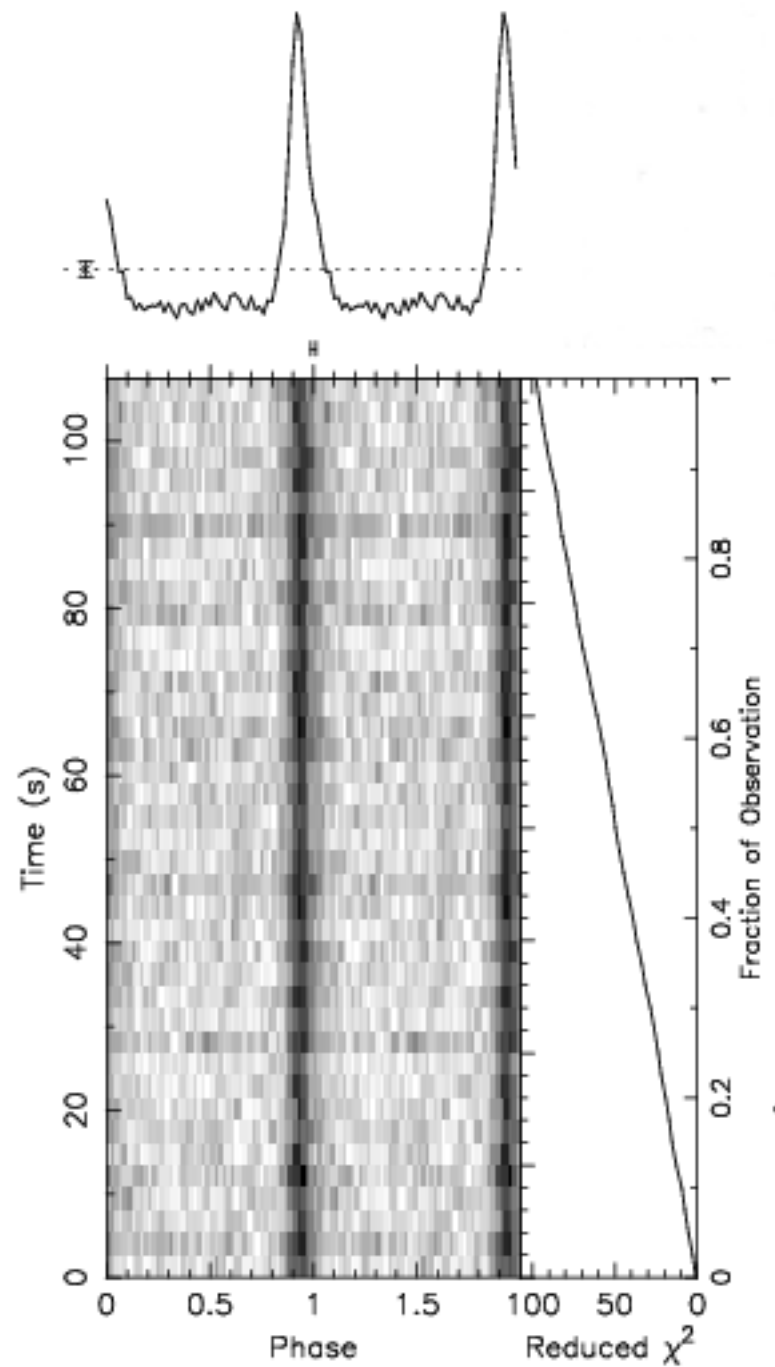
J0741+66

- Period: 2.9ms
- DM: 15
- 4.8 day binary



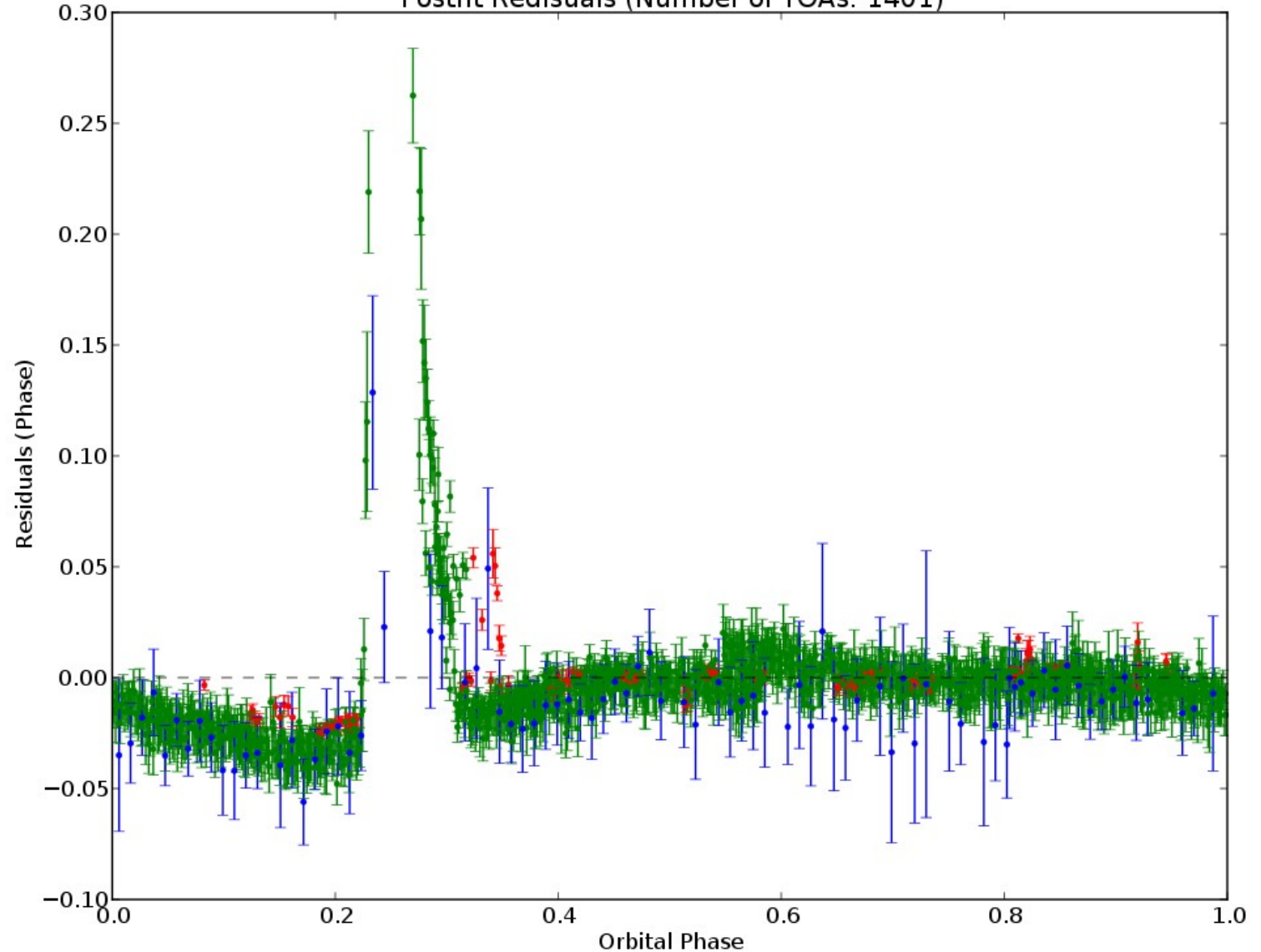
J1122+78

- Period: 4.2ms
- DM: 11
- 15 day binary



J1816+4510

Postfit Residuals (Number of TOAs: 1401)



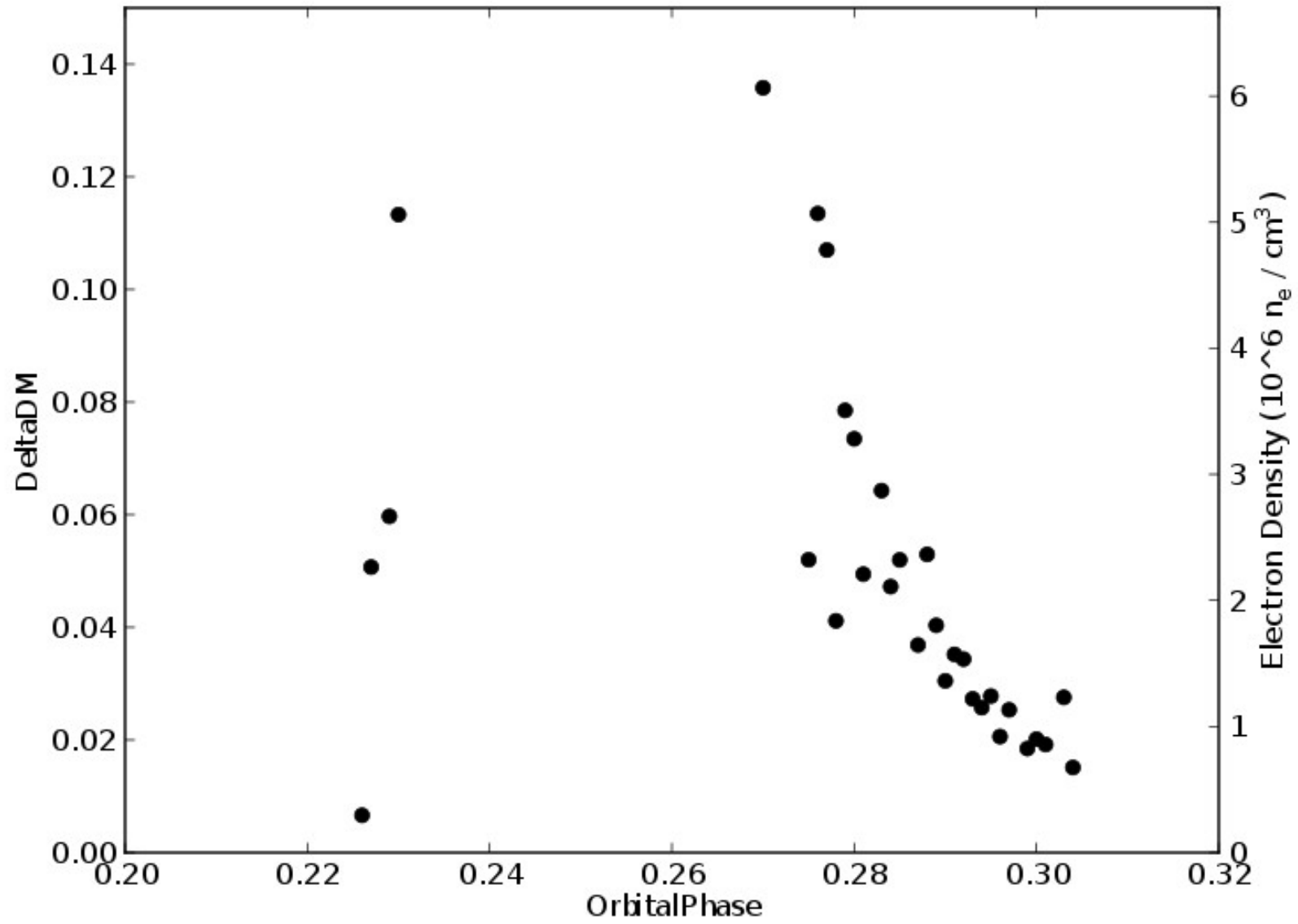
820 MHz:

- “Total eclipse” ~ 4%
~0.23-~0.27
- “Delay eclipse” ~ 8.2%
~0.226-~0.308

350 MHz:

- Eclipse ~ 10%
~0.219-~0.314
- Variable

J1816+45



J0636+51

- J0636+51 is in a ~96 minute orbit with a ~8 Jupiter mass companion.
- Similar to “black widow” systems, but no obvious eclipse/DM variations, yet
- J0636's companion has a minimum density of 43 g/cm³.

