DISCOVERY OF A NEW TYPE OF STAR

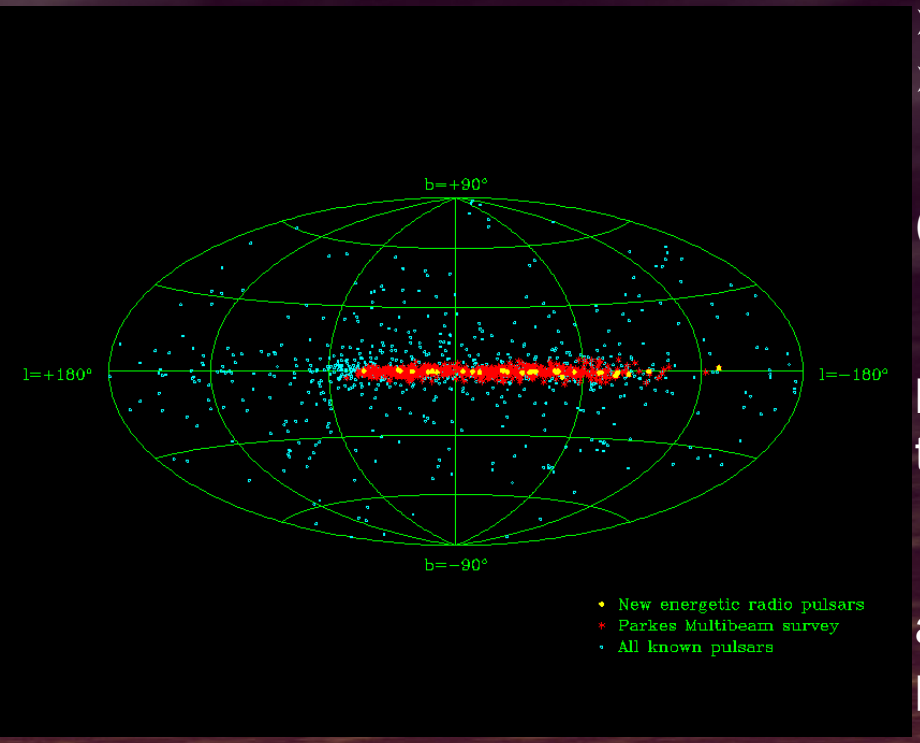
Observations

The 64 meter Parkes radiotelescope, New South Wales, Australia.

January 1998 - February 2002

Australia Telescope National Facility
University of Manchaster's Jodrell Bank Observatory

Observations



- 800 pulsars,
- 11 Rotating Radio Transients (RRATs)

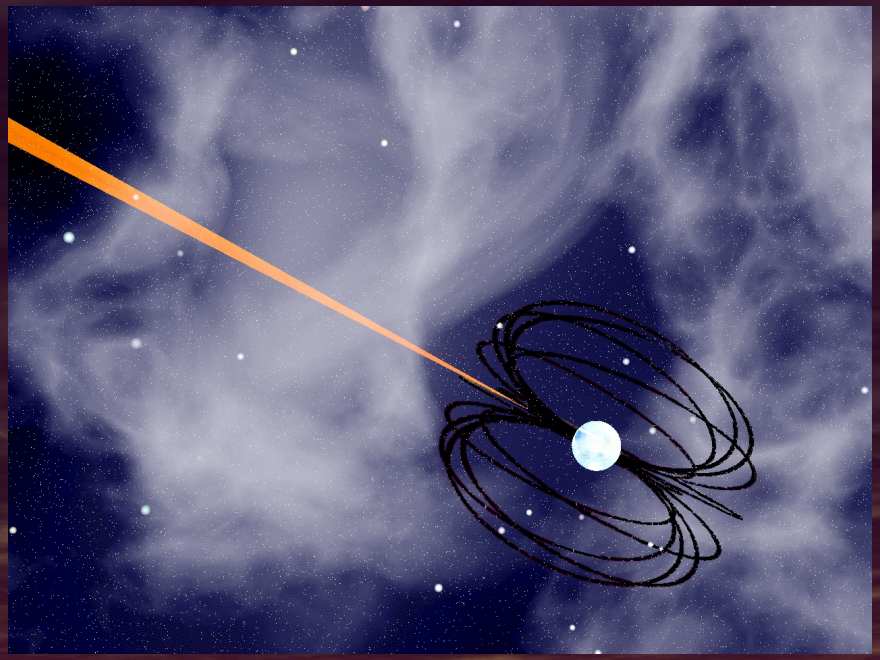
Since August 2003 all the sources (11) have been reobserved.

All have shown multiple burst, with between 4 and 229 events detected in total from each object

The density of sources on the sky appears to be greater towards the Galactic plane (8 of 11 have $|b| < 2^\circ$)

McLaughlin, M. A. et al. 2006, Nature

Rotating Radio Transients

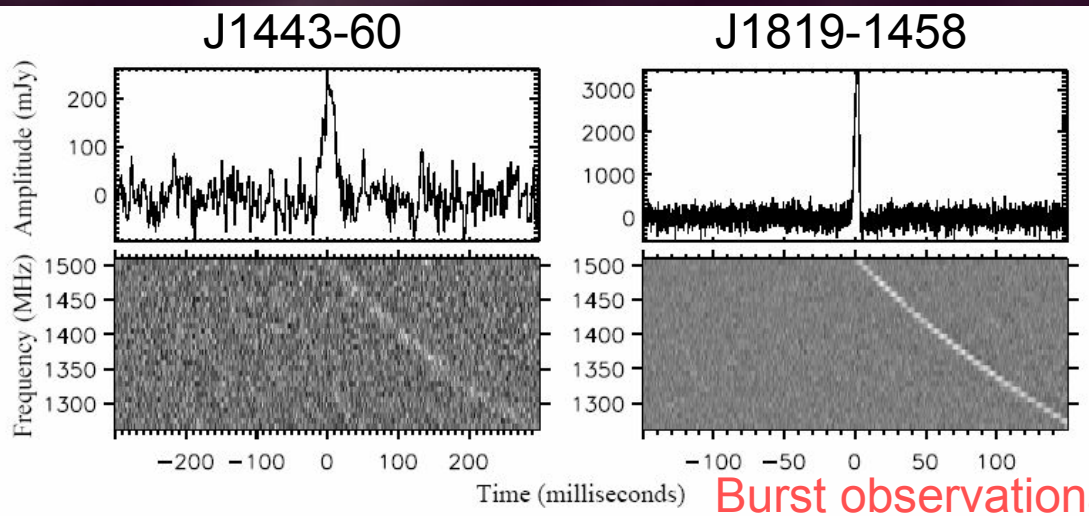


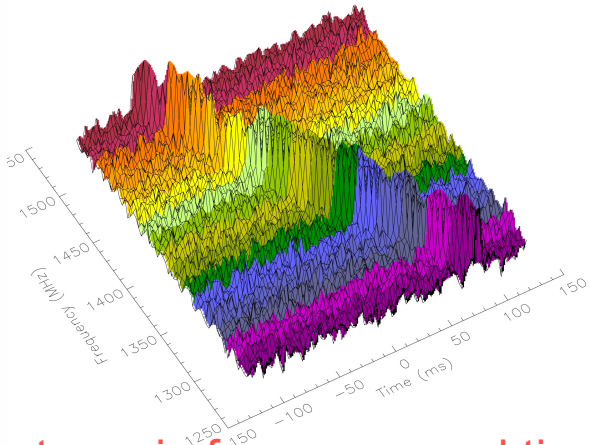
Visualisation of a neutron star, showing the magnetic field lines and the radio beam emanating from a magnetic pole

Durations:	2 – 30 ms
Time interval between burst:	4 min – 3 h
Periodicities:	0.4 – 7 s (for 10 sources)

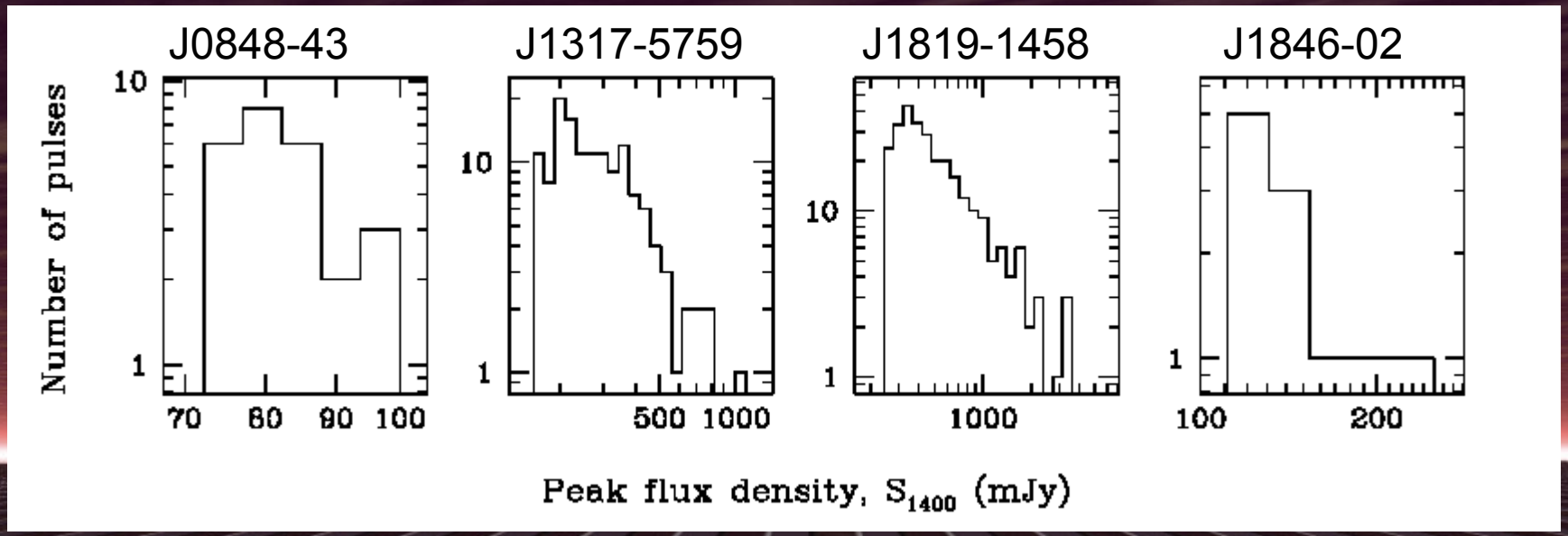
5 of 10 P > 4 s,

Rotating Radio Transients





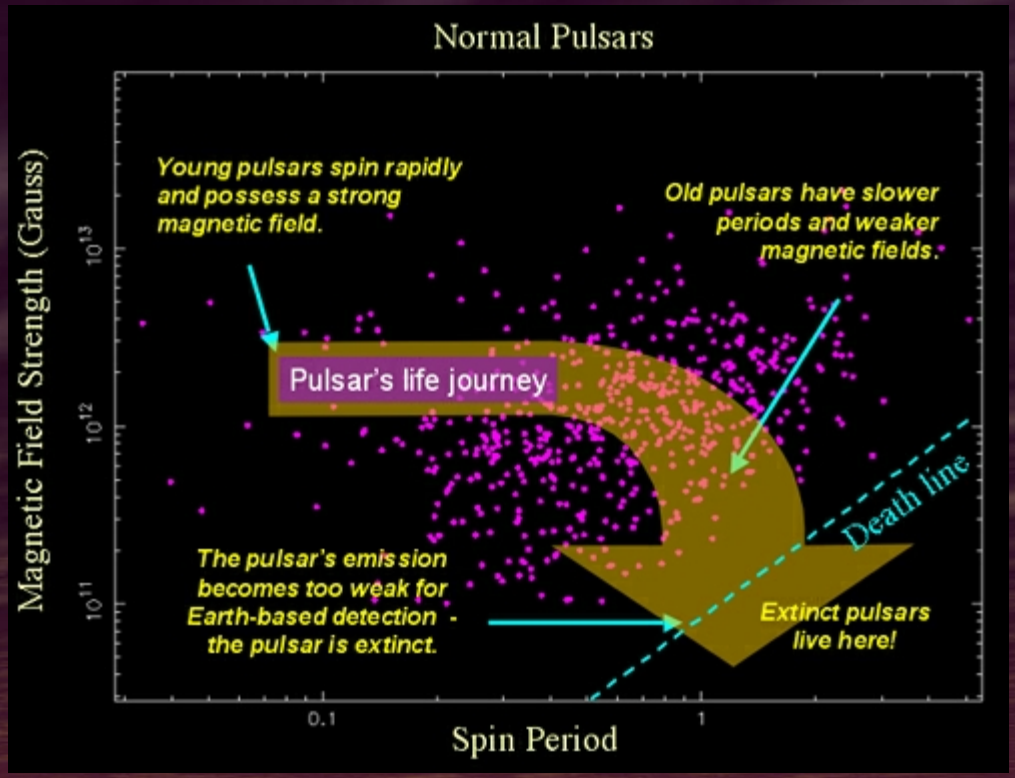
Burst observational signatures in frequency and time



Typical burst intensities

Physical interpretation of Rotating Radio Transients

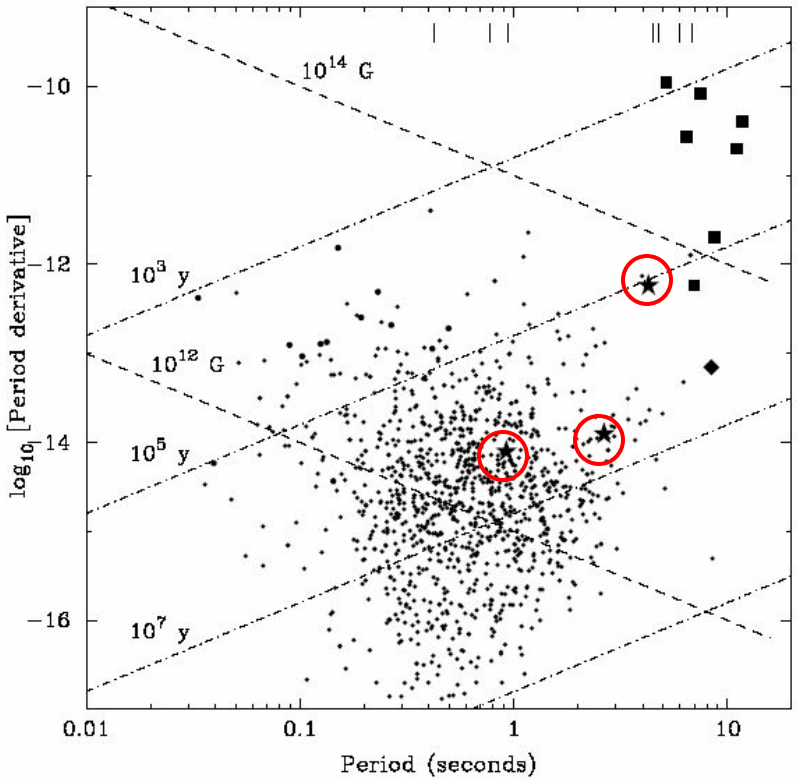
MODEL I – RE-ACTIVATED DEAD PULSARS

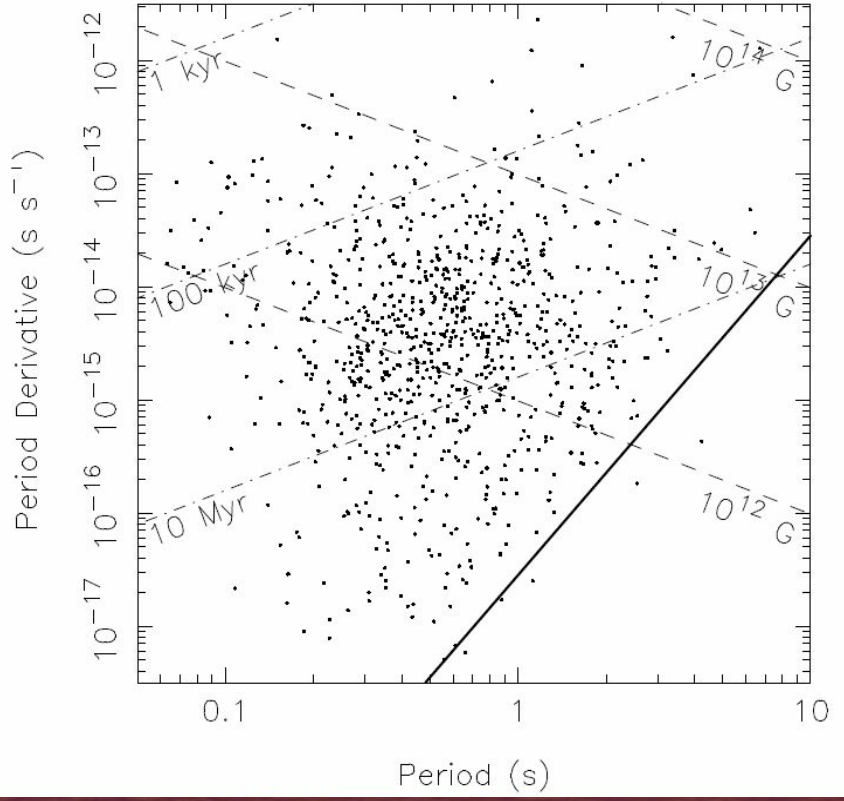


Zhang, B., Gil, J., Dyks, J. 2006, submitted to the Astrophysical Journal Letters

Physical interpretation of Rotating Radio Transients

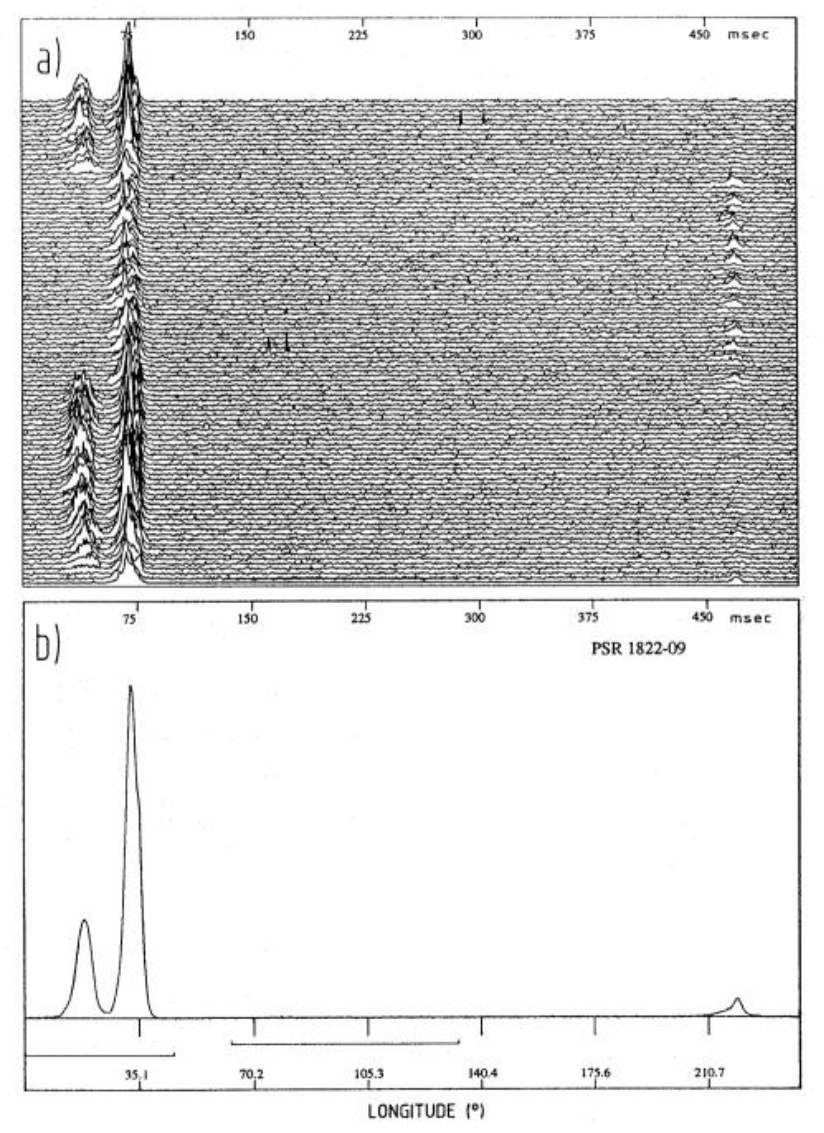
MODEL I – RE-ACTIVATED DEAD PULSARS





Physical interpretation of Rotating Radio Transients

MODEL II: REVERSED NORMAL NULLING PULSARS



PSR B1822-09

Gil, J. et al. 1994, A&A, 282, 45

Physical interpretation of Rotating Radio Transients

MODEL : PSR B1822-09

Dyks, J. et al. 2005, ApJ, 626, 45

1) The mechanism of coherent radio emission must allow radiation into two, opposite, direction.

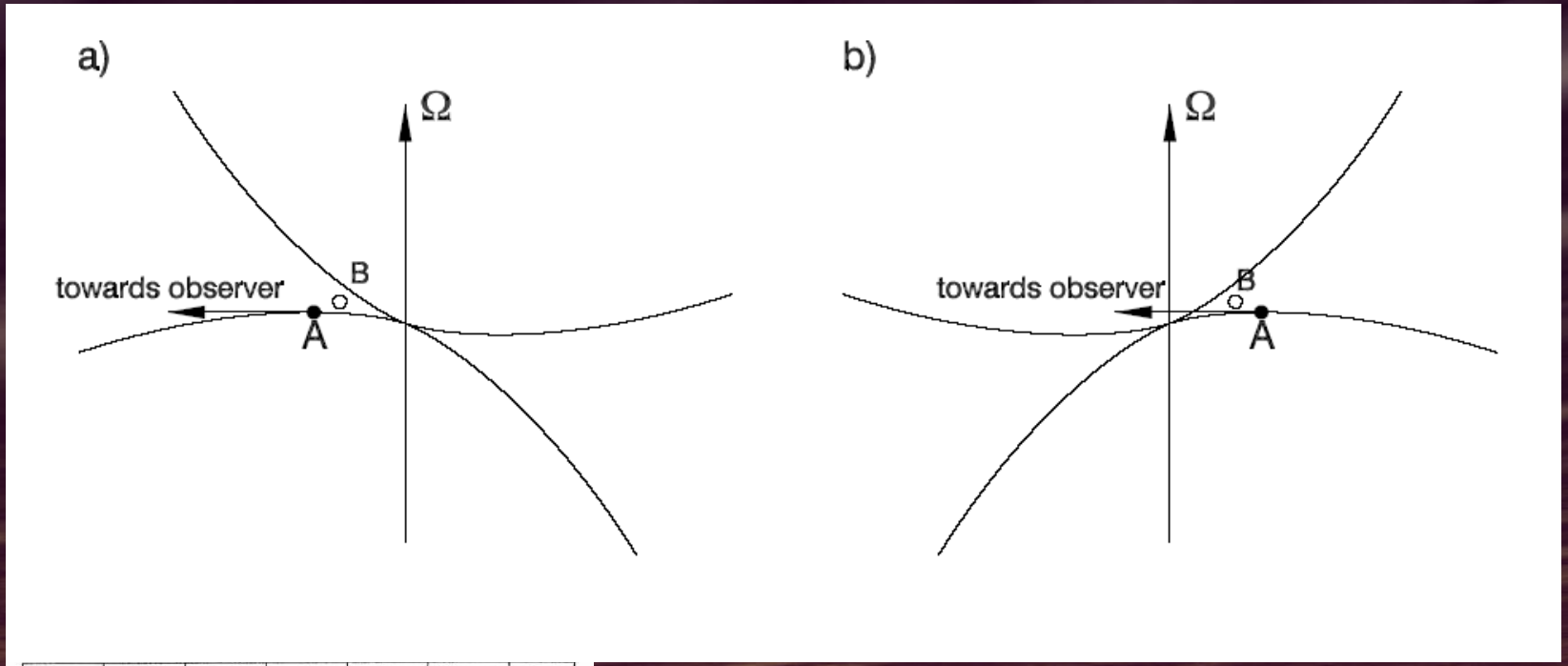
3) The radio waves must be able to propagate throuh inner regions of the neutron star magnetosphere with strong magnetic field.

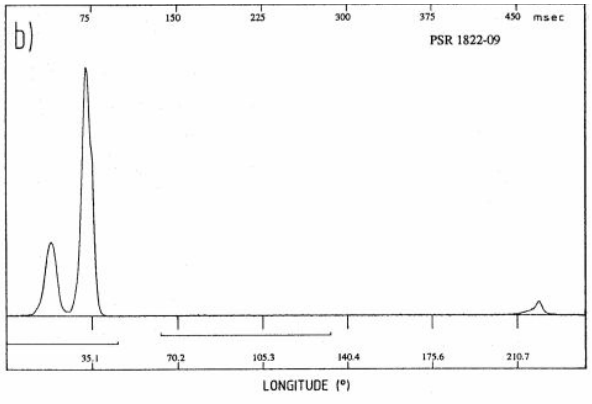
The models implies inward radio emission in pulsar magnetosphere.

Physical interpretation of Rotating Radio Transients

MODEL II: REVERSED NORMAL NULLING PULSARS

Dyks, J. et al. 2005, ApJ, 626, 45





Physical interpretation of Rotating Radio Transients

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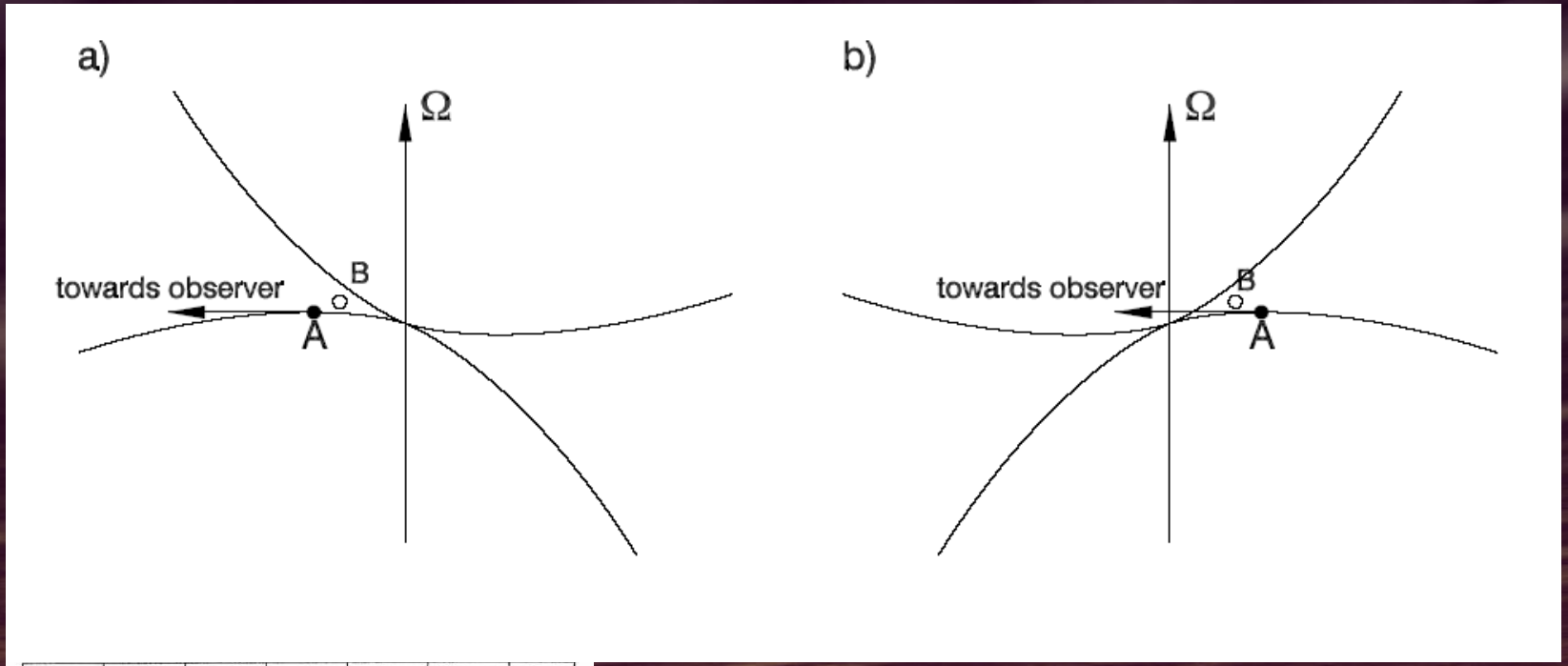

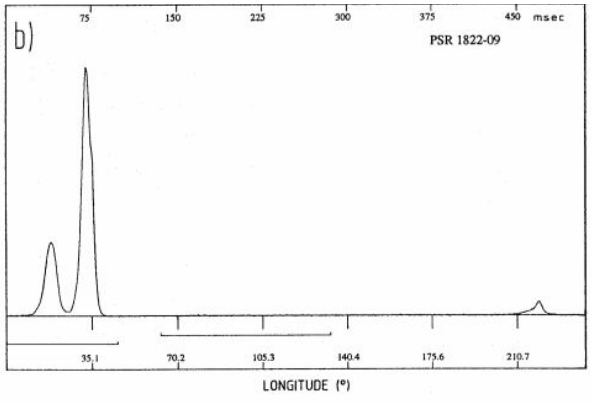

RRAT – observation of reversed inward-directed pulse component

X-ray data

MODEL I (RE-ACTIVATED DEAD PULSARS)
– Strong X-ray emission is not expected, except the thermal component from the cooling neutron star

MODEL II (REVERSED NORMAL NULLING PULSARS)
– The X-ray emission properties (luminosity and spectrum) of RRATs should be similar to those of normal, middle-age/old pulsars

Observations

RRAT J1819-1458 was detected with *Chandra* by Reynolds et al. (2006)

Observations:
23, 25, 28 May 2005.

Spectrum :
- **similar to those of comparably-aged radio pulsar,**
- **dominated by a soft thermal component from the cooling neutron star**

The data are consistent with both models !