

RRATs: An Update

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- These are "slowly" rotating (compared to PSRs) NSs which emit very occasional bright bursts of radio emission of which there are thought to be many sources.
- Unlike PSRs they are not detectable from Fourier methods but rather through searches for individual bright bursts.

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- Timing with Lovell Telescope (Aug '08 ->)
- Simultaneous Observations Radio (Sep '08, analysis ongoing)

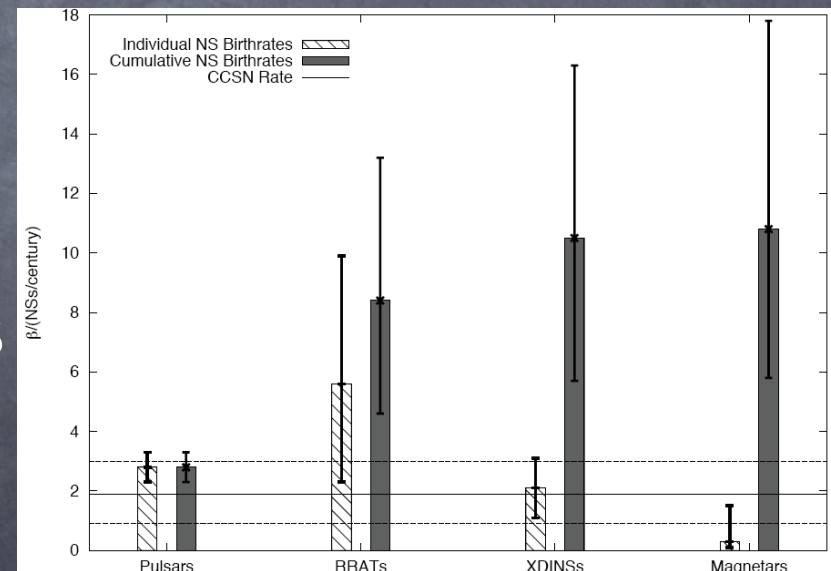
Counting Neutron Stars

- Now there are many different types of NSs which we know about: radio PSRs, MSPs, RRATs, XDINSs, magnetars, CCOs.
- All* should form in Type II SNe.
- Luckily these explosions leave a lot of evidence lying around so we can deduce how often they occur.
--> Observed Galactic CCSN Rate = 2/century
- But this does not seem to be enough!

Counting Neutron Stars

- It seems that to explain currently observed populations we need a NS creation rate of 11/century.

- Know that young PSRs are not evolving according to our standard PSR model
- Perhaps RRATs and magnetars are evolutionary end-points of PSRs ?



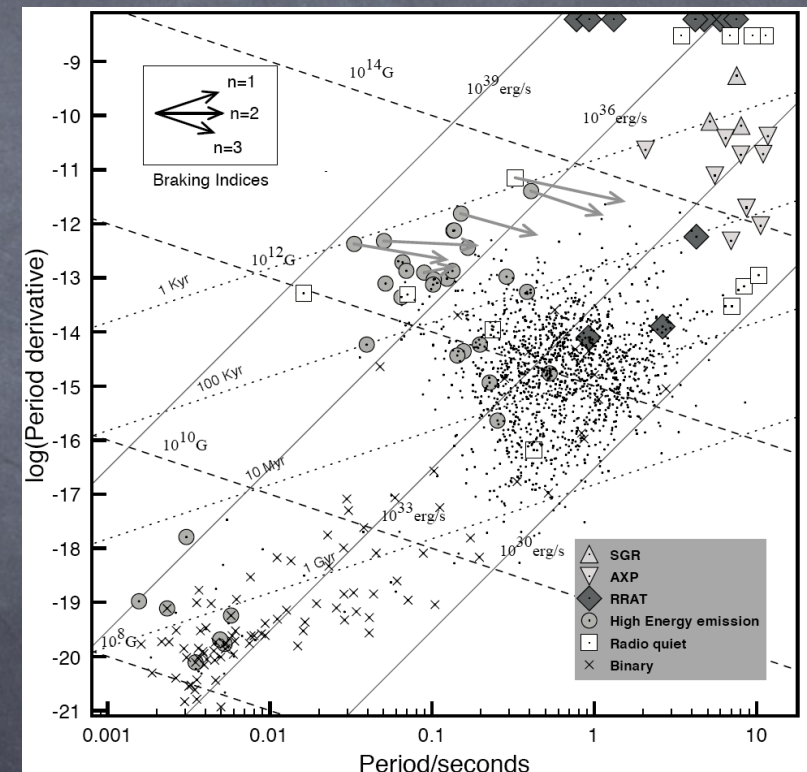
- Different formation processes ?
Estimates just wrong ? Want to find more ...

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- Why? Want to find more RRATs & have improved RFI mitigation which should enable this. Also PSR Group's new HYDRA cluster (1500 processors) makes re-processing much quicker.
- Initial processing is now 95% complete.
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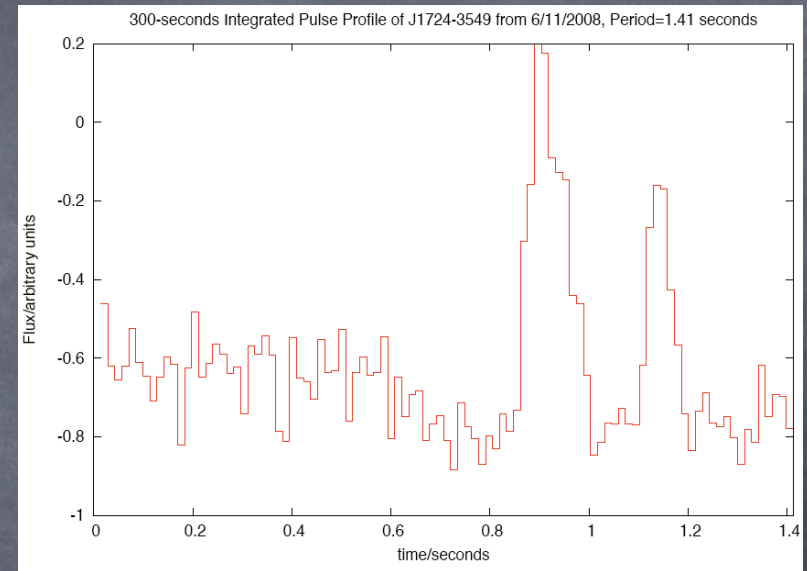
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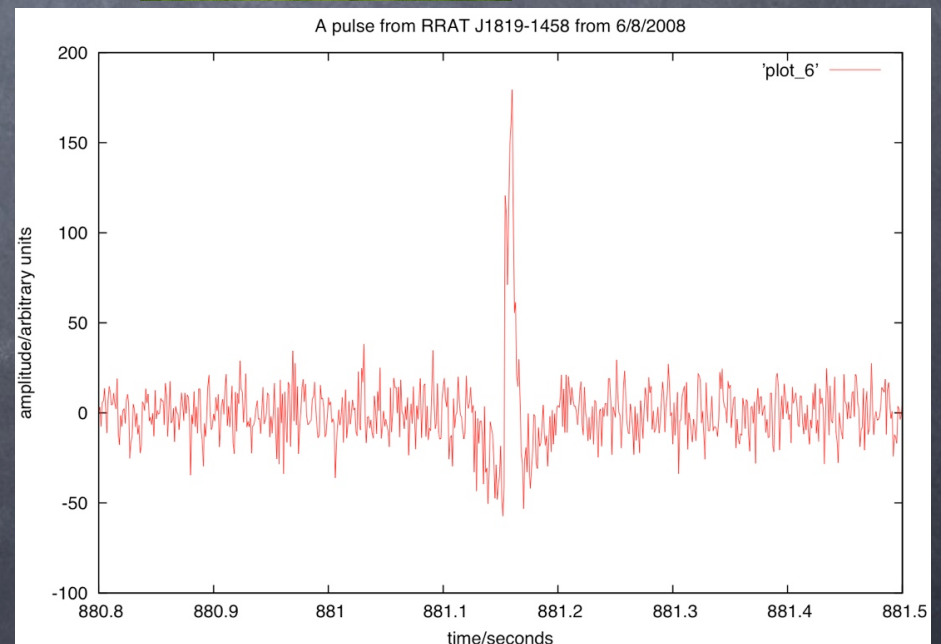
Re-processing the PMPS

- A small number of these looked through already!
- 1 new RRAT/ON-OFF PSR discovered & confirmed several times, 1 new RRAT discovered & observed twice, many promising candidates.
- Observations of candidates to start in earnest in the next PKS semester (from April '09).
- Hopefully many new RRATs to report at next ESTRELA Meeting!



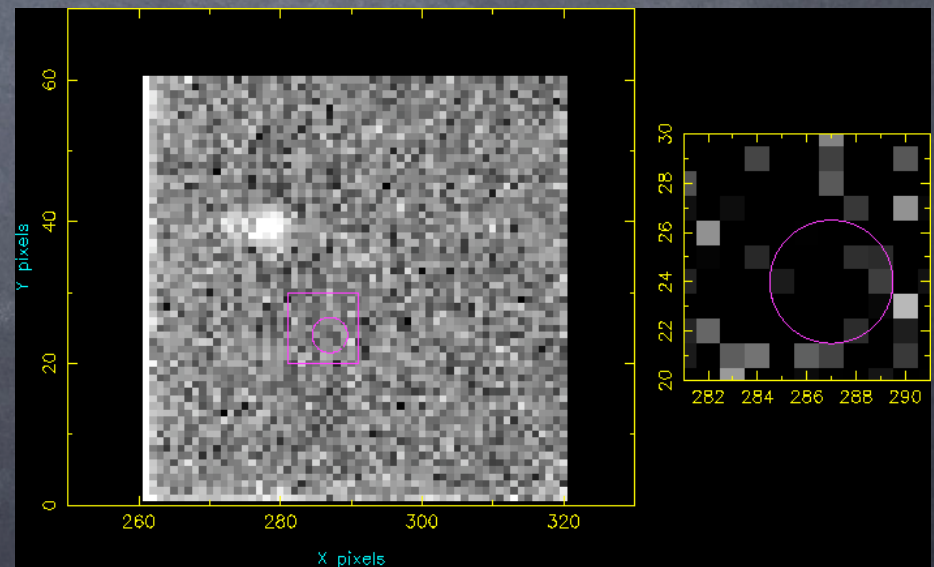
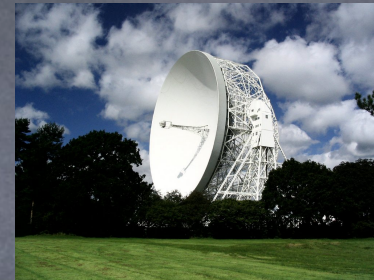
Simultaneous Observations Optical

- Performed simultaneous radio-optical observations of RRAT J1819-1458
- Lovell telescope (@ 1.4 GHz)
- William Herschel Telescope (u', g' & i' using ULTRACAM)
- A possible detection (!) but only 2.5 sigma
--> more data please!



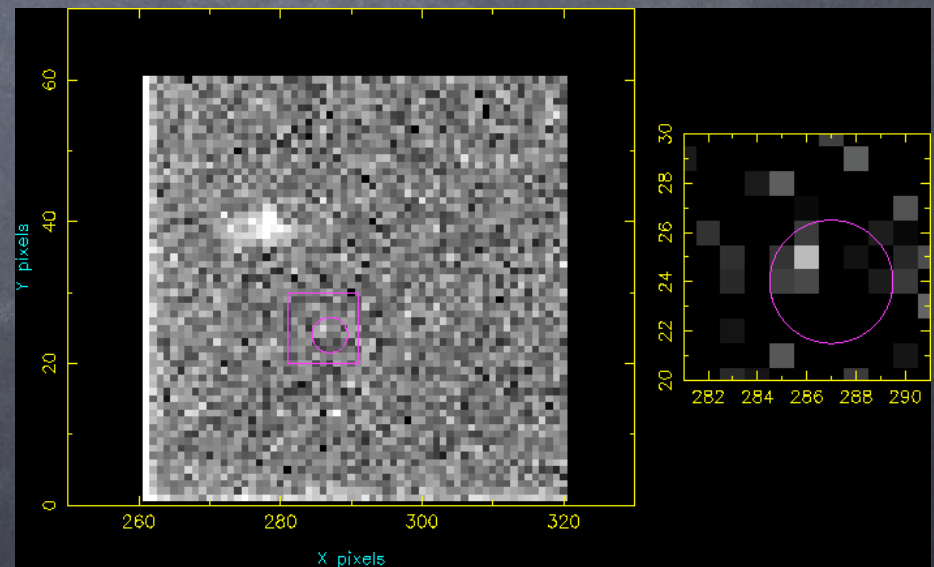
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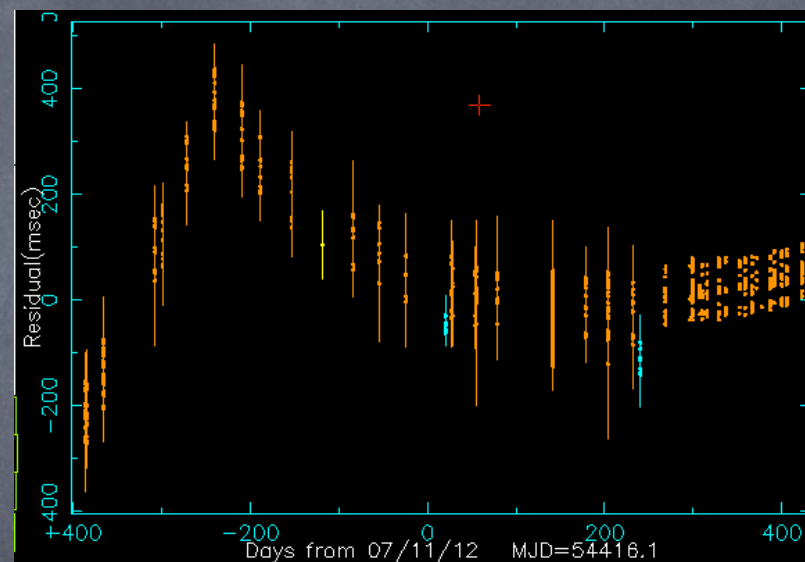


Timing with Lovell Telescope

- Began timing campaign of 2 RRATs at JBO:
RRAT J1819-1458 & J1913+1333
- “Timing” == model P , $\dot{P}$, $\ddot{P}$, ... as a fn. of time.
- JBO timing solution now coherent over last 160 days.
- Can join to previous data for coherent fits over last 1100 & 1350 days for 1819 & 1913 respectively.
- Some discoveries from 1819 timing!

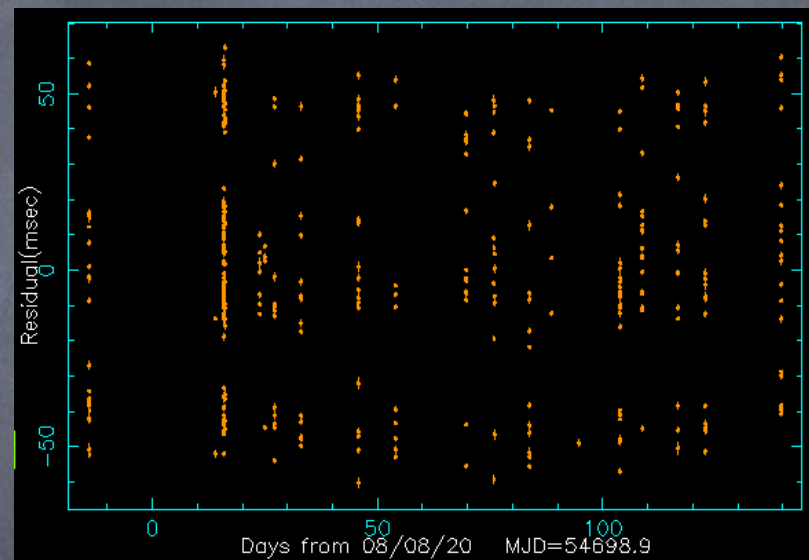
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- It glitches! 2 glitches seen so far. Waiting patiently for next one...
- We see 3 phase windows where emission is allowed. Emission criteria only satisfied in these areas of the magnetosphere?
- To Do List: Polarisation observations of these 3 components using the newly acquired DFB at JBO.



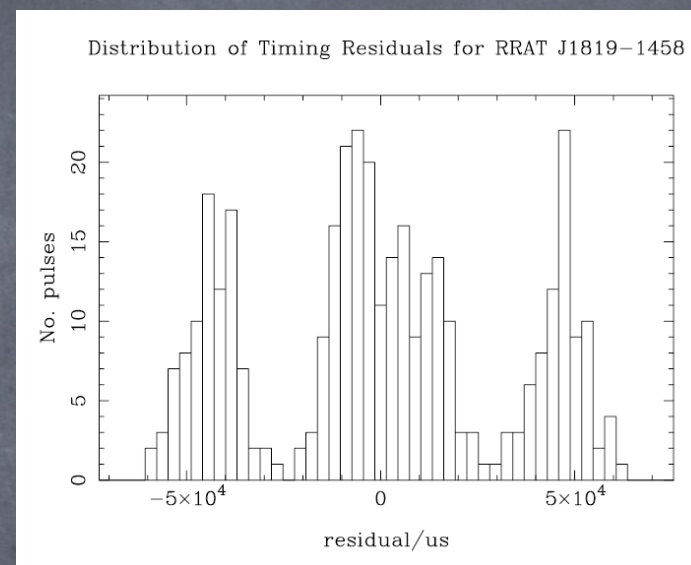
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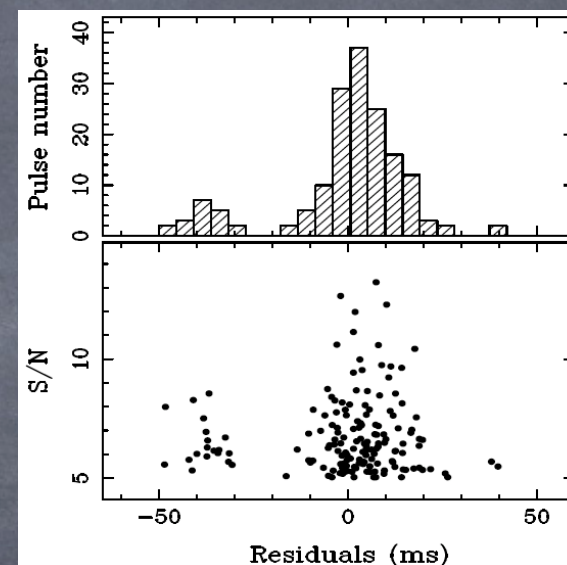
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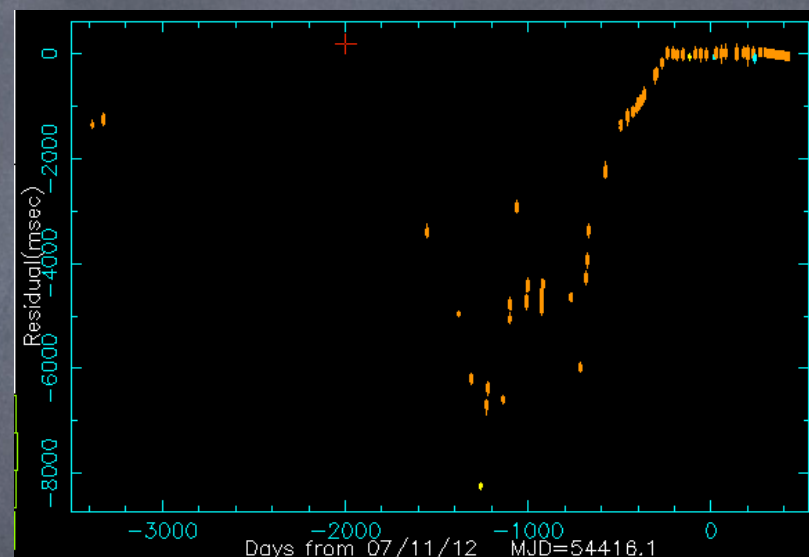
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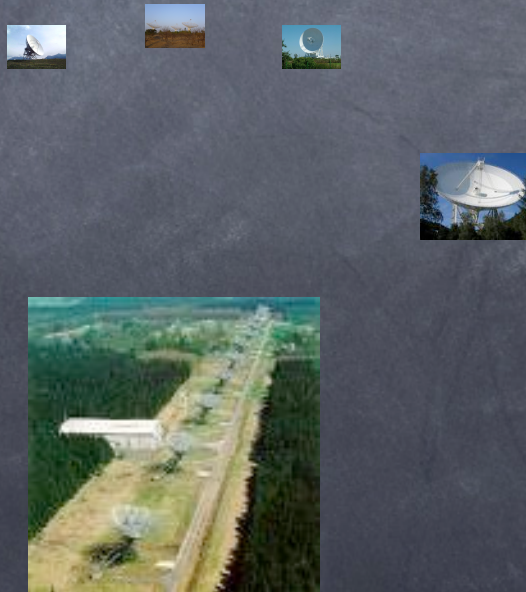
Simultaneous Observations Radio

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Simultaneous Observations Radio

- Analysing most promising dataset at present – that of 1819.
- **Still a work in progress** but it seems that for this RRAT that :
 - i. spectral index changes from pulse to pulse
--> not a simple power-law as usually assumed?
 - ii. pulses are possibly narrow-band.
--> higher burst rates if considering all freq.

Future Work

- Finish PMPS processing & thrall through results
--> find lots of things! --> follow these up!
- Finish simultaneous radio observations analysis.
- Re-try the optical-radio experiment using
ULTRACAM, ULTRASPEC, GASP (?) detectors.
- Continue timing ... waiting for glitches!
- Secondment in Bonn

Thank You

References & Credits

👁 Papers:

Galactic CCSN Rate, Diehl et al. (2006), *Nature*, 439, pp 45–47 (astro-ph/0601015).

NS Counting, Keane & Kramer (2008), *MNRAS*, 391, pp 2009–2016 (astro-ph/0810.1512).

PMPS re-processing, Eatough, Keane & Lyne (2009), *MNRAS*, in press (on astro-ph this week ...).

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WHT results frames, V. S. Dhillon.

Urumqi 1819 residuals, Esamdin et al. as above.

Torun picture, eVLBI webpages, <http://www.evlbi.org/evlbi/te024/>

[Torun_telescope.jpg](#)

GMRT picture, <http://farm1.static.flickr.com/>

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