

# Discovery of two energetic gamma-ray pulsars in SNRs MSH 11-62 and CTB 37A

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**SANTA CRUZ**

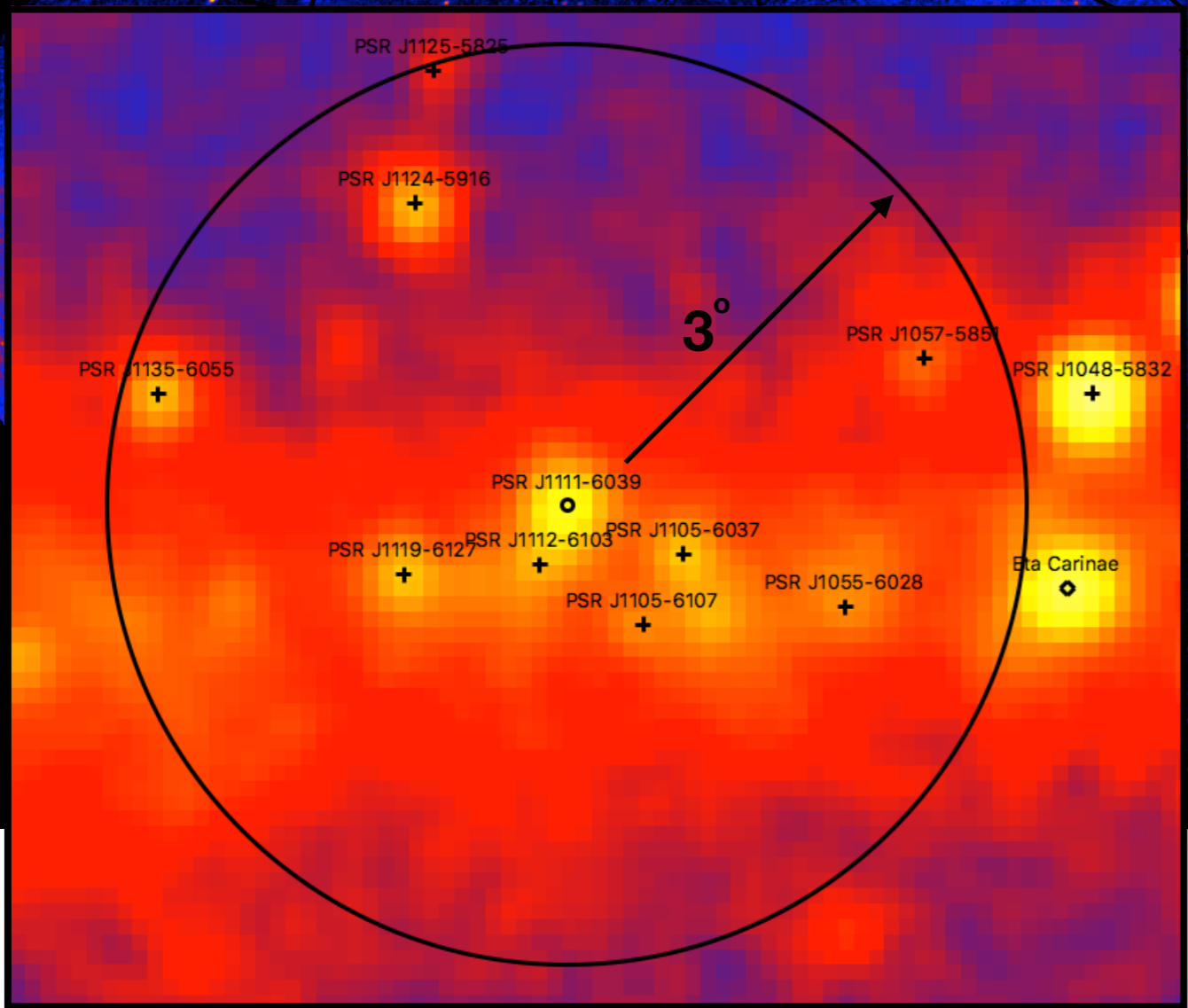
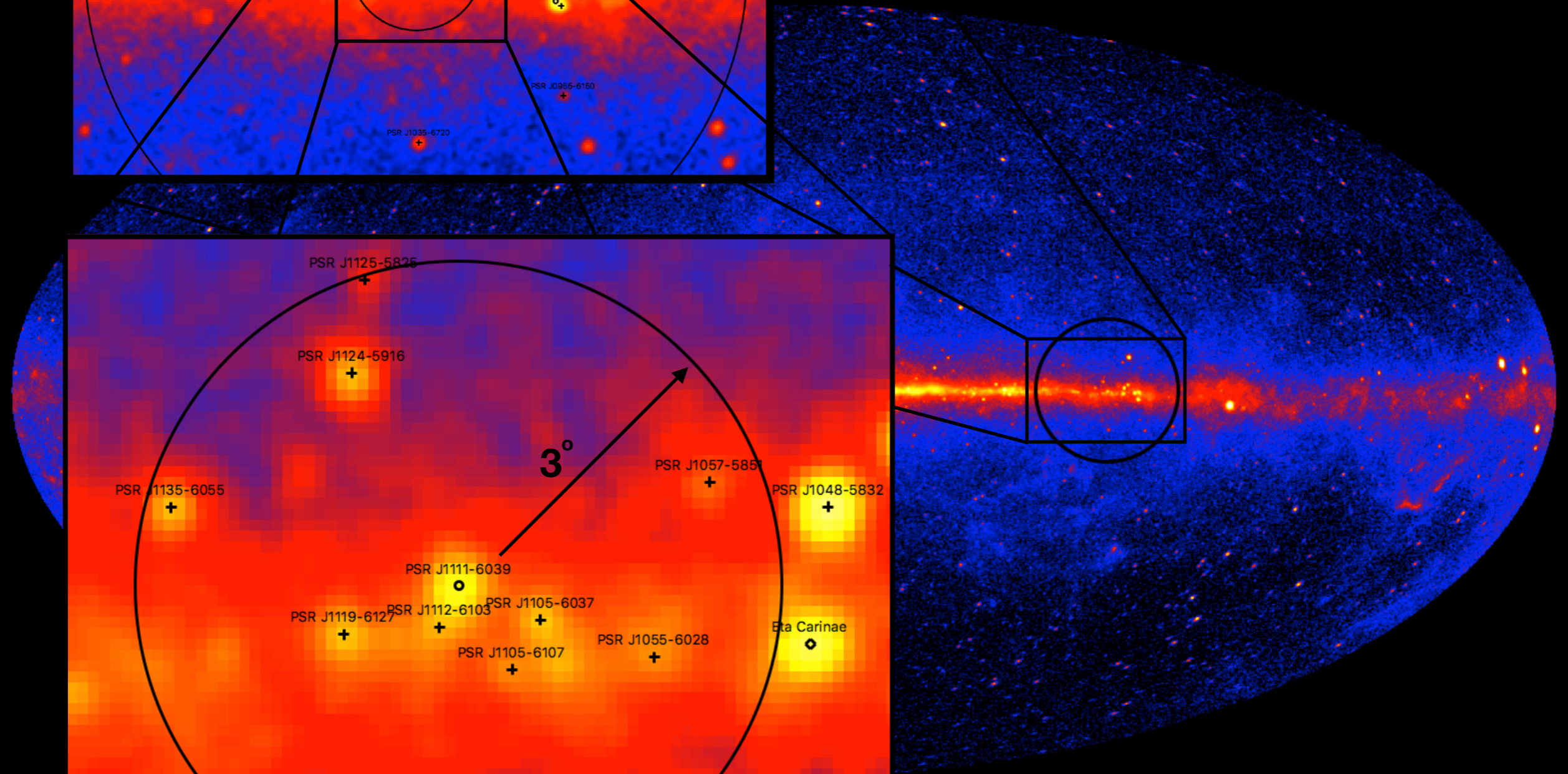
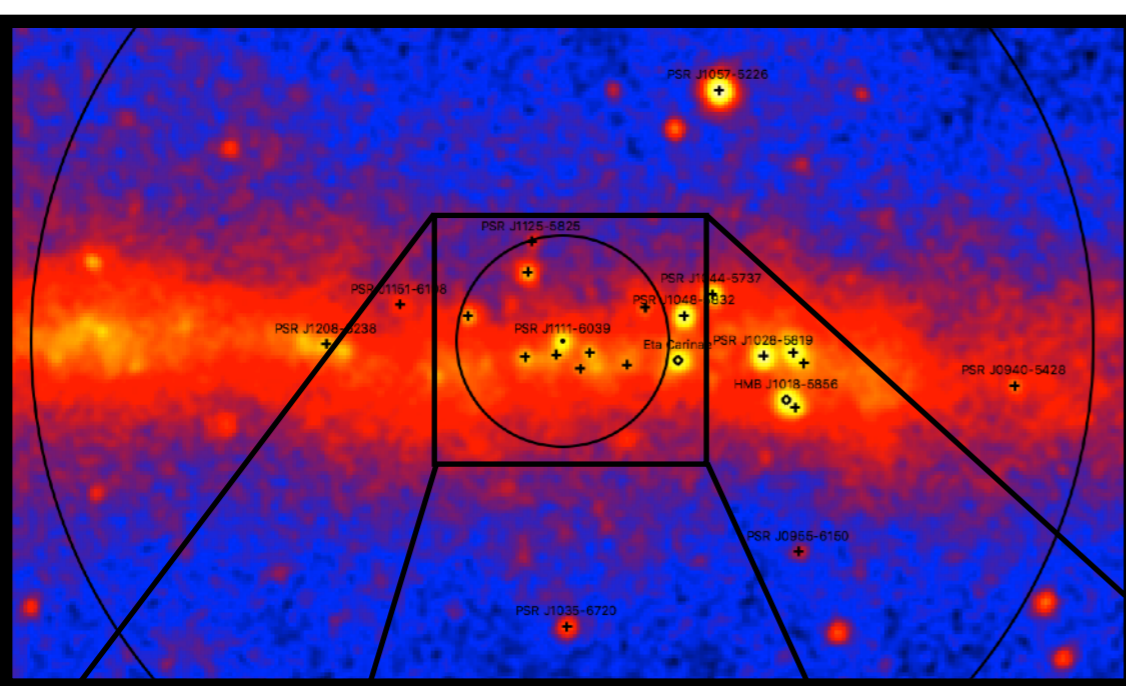
8th International Fermi Symposium  
Baltimore, MD, 17 October 2018

# SNR MSH<sup>\*</sup> 11-62 (G291.0-0.1)



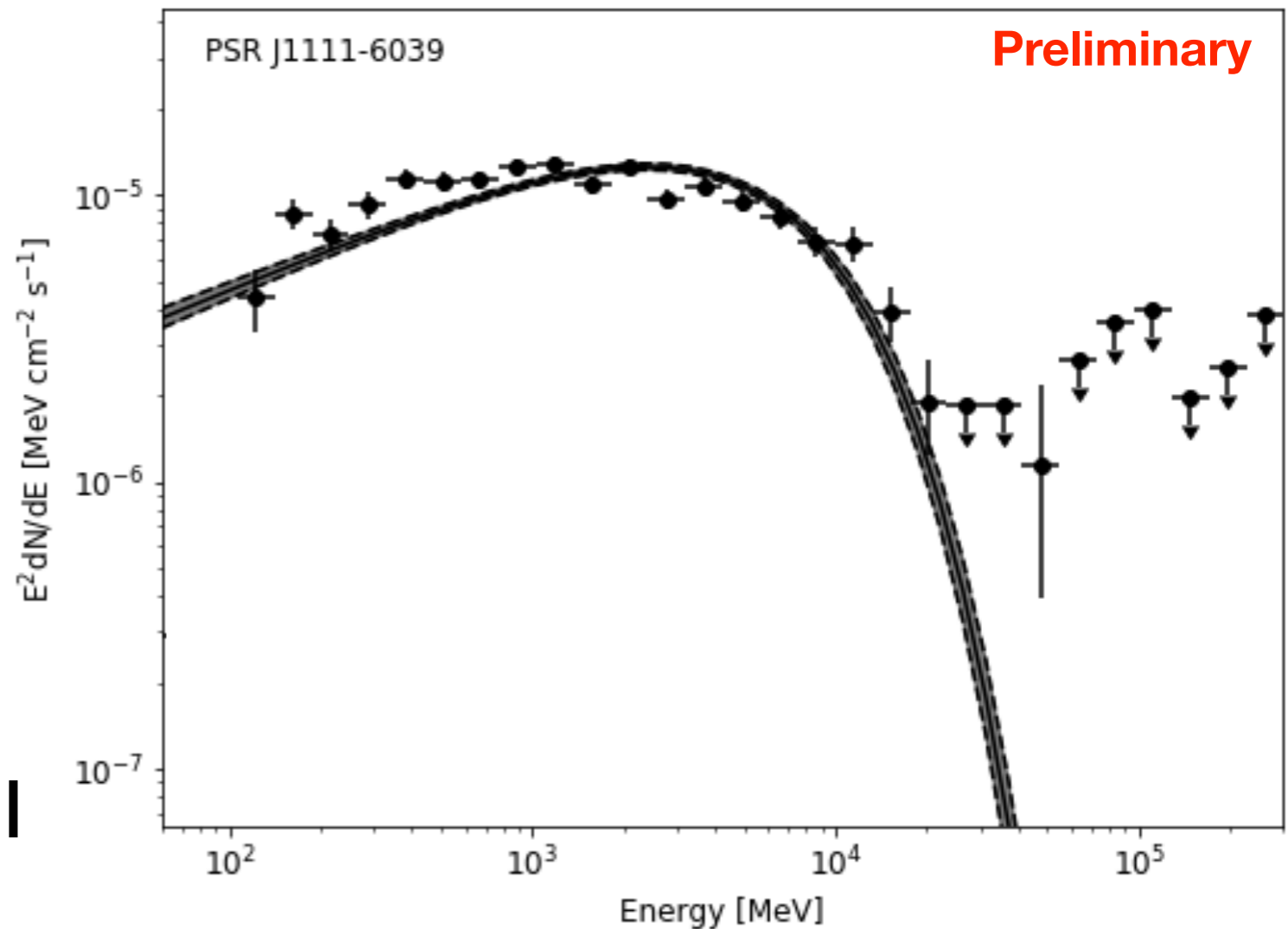
\*[Mills, Slee, & Hill 1961]

# PSR J1111-6039



# Fermi LAT spectral analysis

- 10-years of LAT data
- Present in many catalogs:  
FL8Y J1111.8-6039,  
3FHL J1111.8-6038,  
3FGL J1111.9-6038,  
2FGL J1112.1-6040,  
1FHL J1111.5-6038,  
1FGL J1112.1-6041c
- E. flux:  
 $6.4 \times 10^{-11}$  erg cm<sup>-2</sup> s<sup>-1</sup>
- E. Cutoff:  
5.4 +/- 0.4 GeV



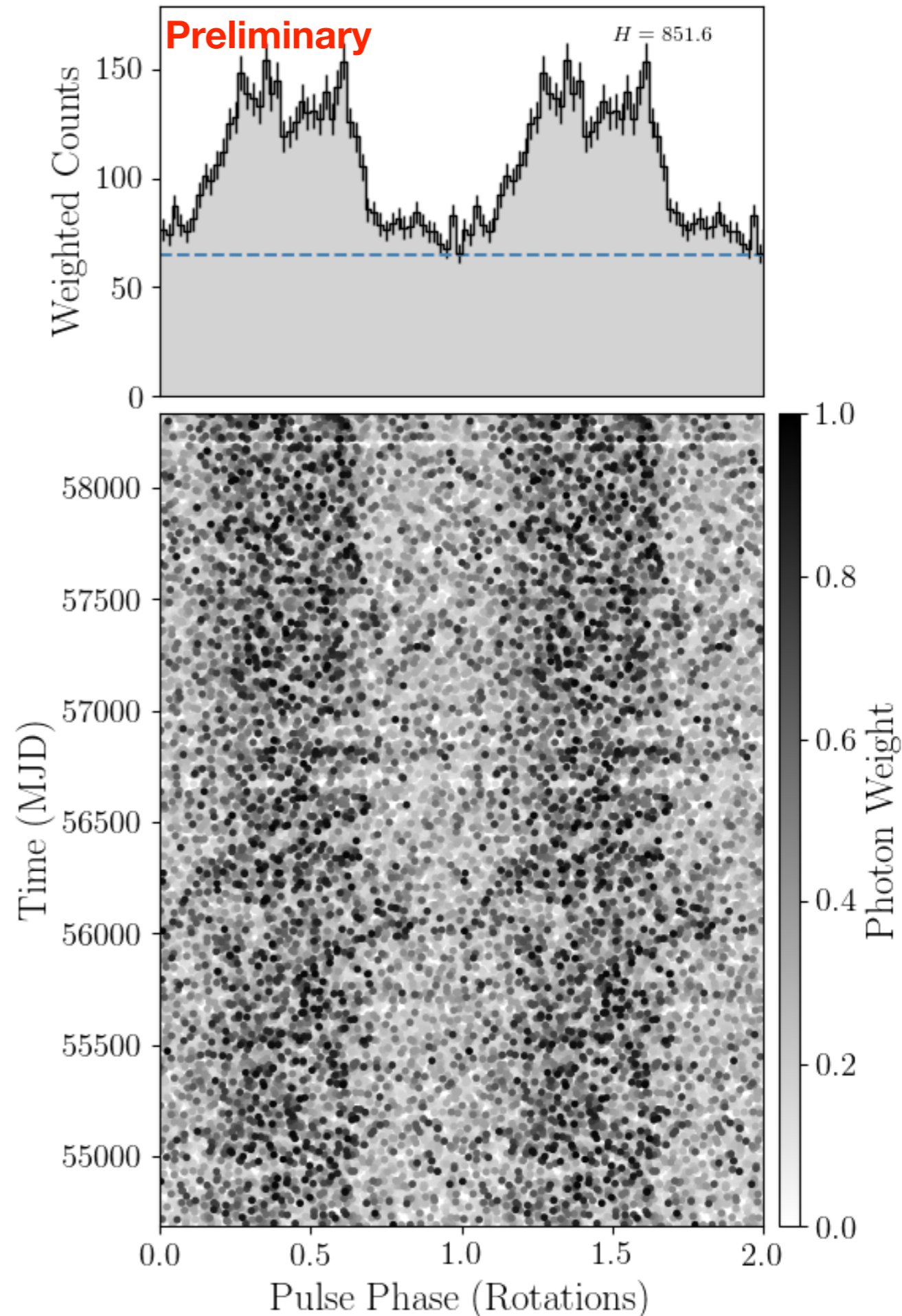
# PSR J1111-4039: Derived Properties

$$\dot{E} \sim 7 \times 10^{36} \text{ erg s}^{-1}$$

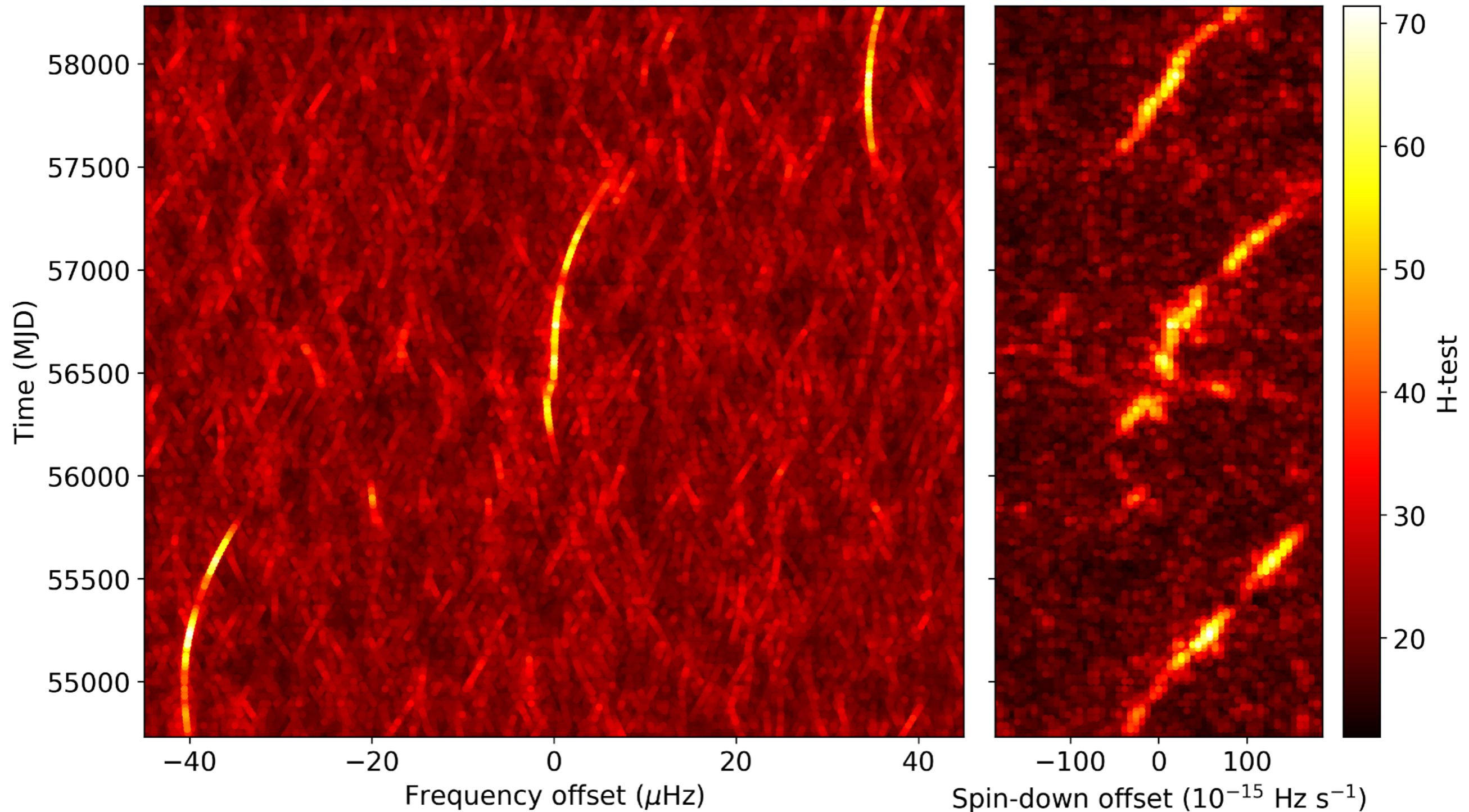
$$B_s \sim 4.9 \times 10^{12} \text{ G}$$

$$\tau \sim 7.8 \text{ kyr}$$

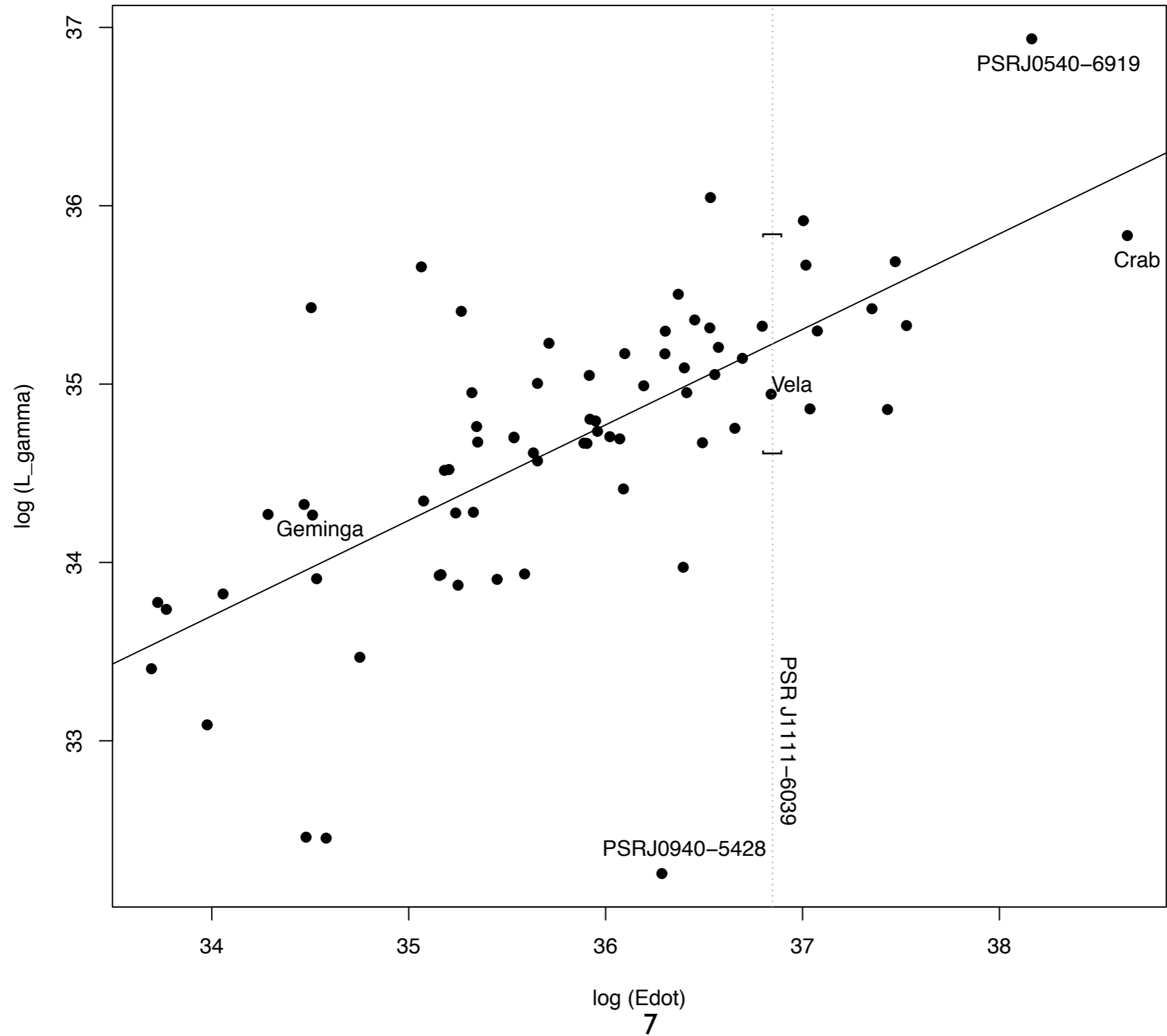
**No radio pulsations**  
**No X-ray pulsations**  
**(new 85 ks *Chandra* observation)**



# Glitches and timing noise in PSR J1111-4039



# Distance estimate



# Multi-wavelength view of SNR CTB 37A

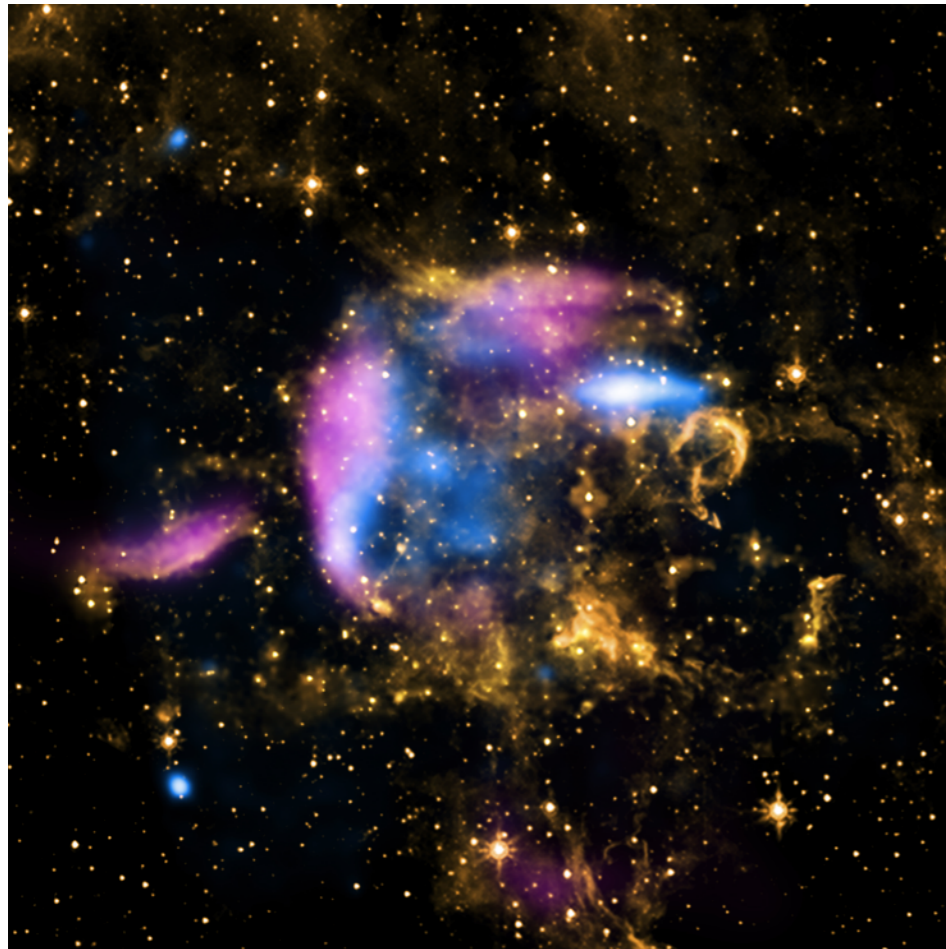
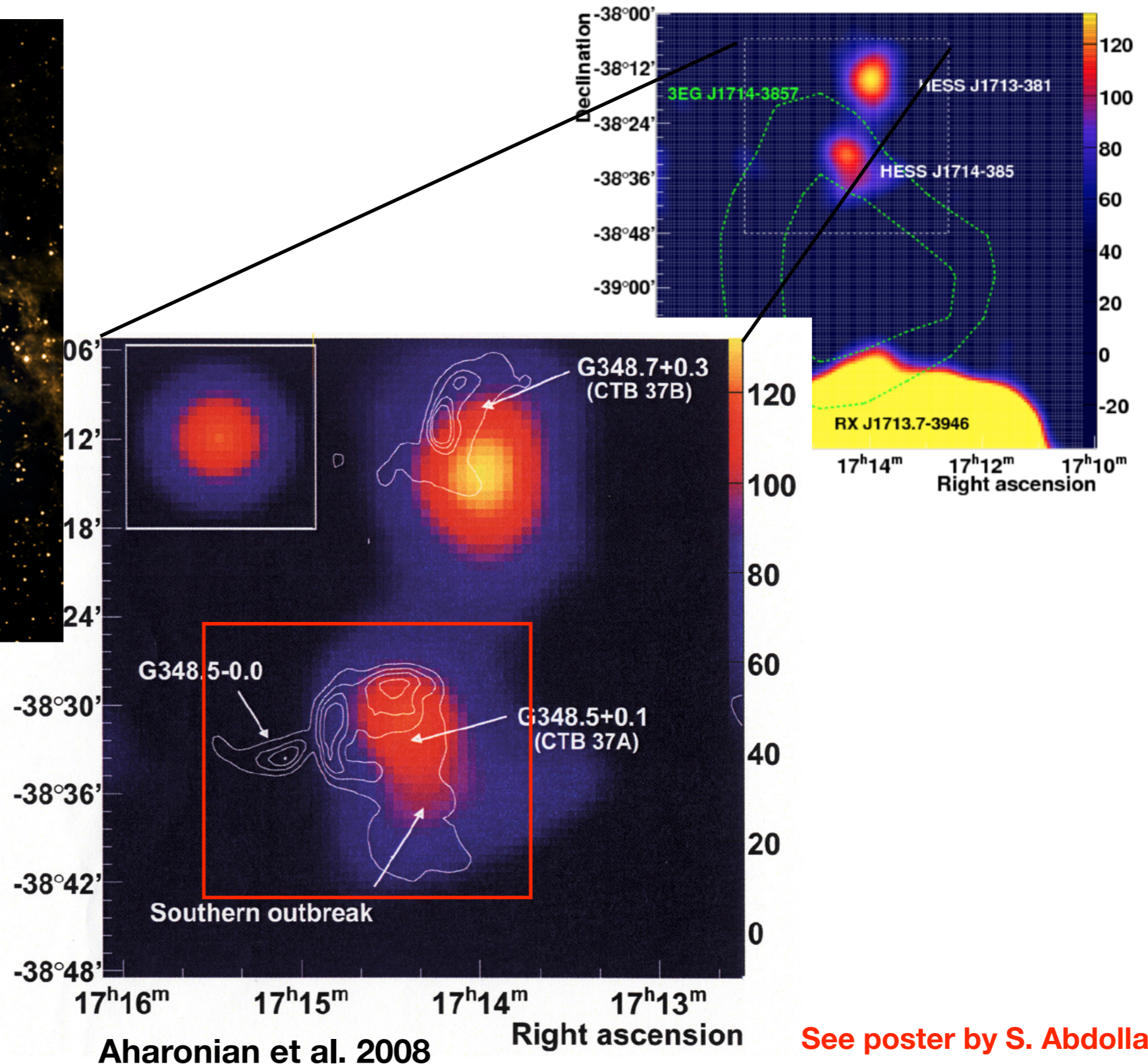


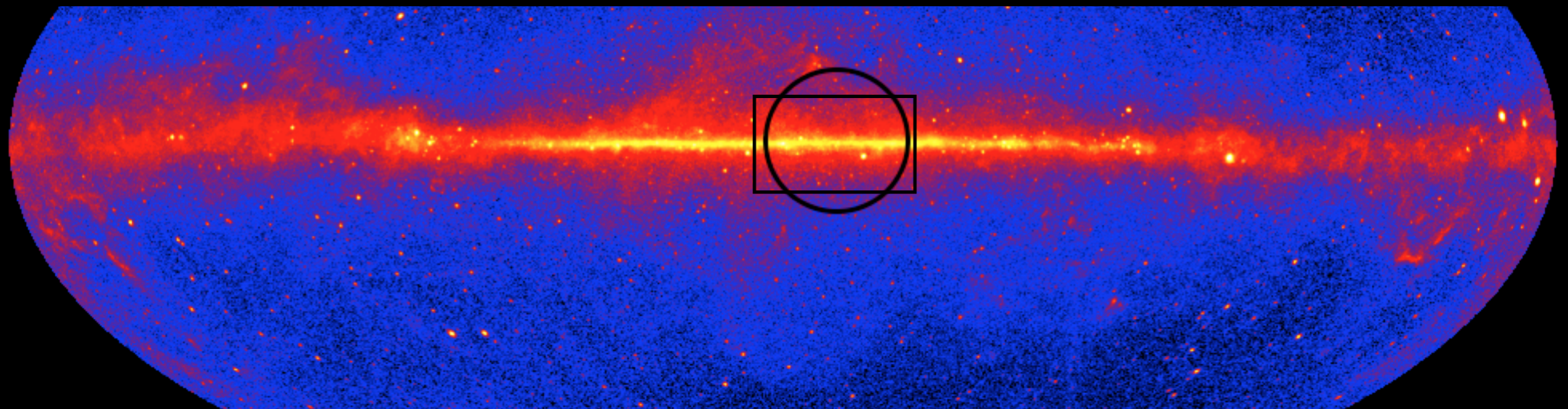
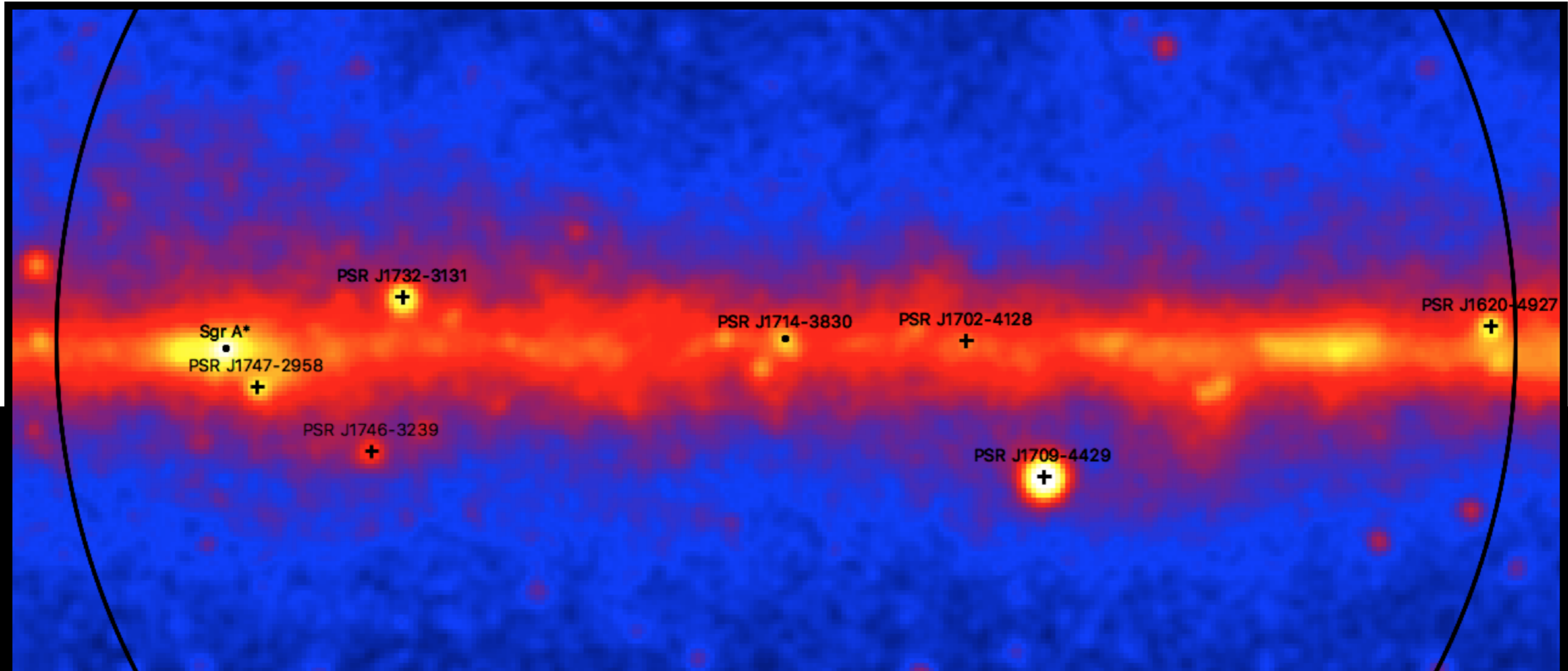
Image credit: X-ray: NASA/CXC/Morehead State Univ/T.Pannuti et al;  
Radio: Molonglo Obs. Synthesis Tel.;  
Infrared: NASA/JPL-Caltech



See poster by S. Abdollahi



# PSR J1714-3830

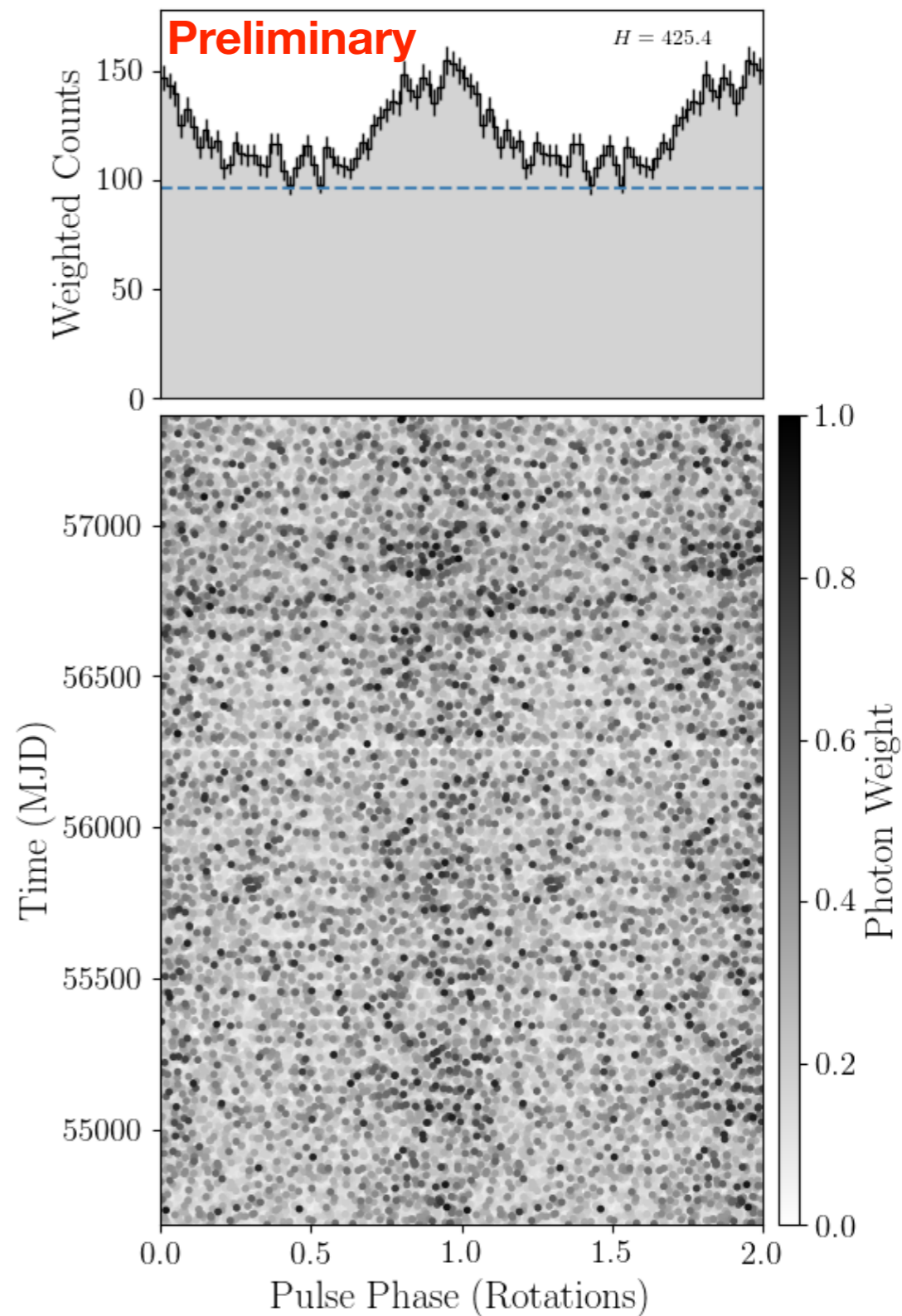


# PSR J1714-3830: Derived Properties

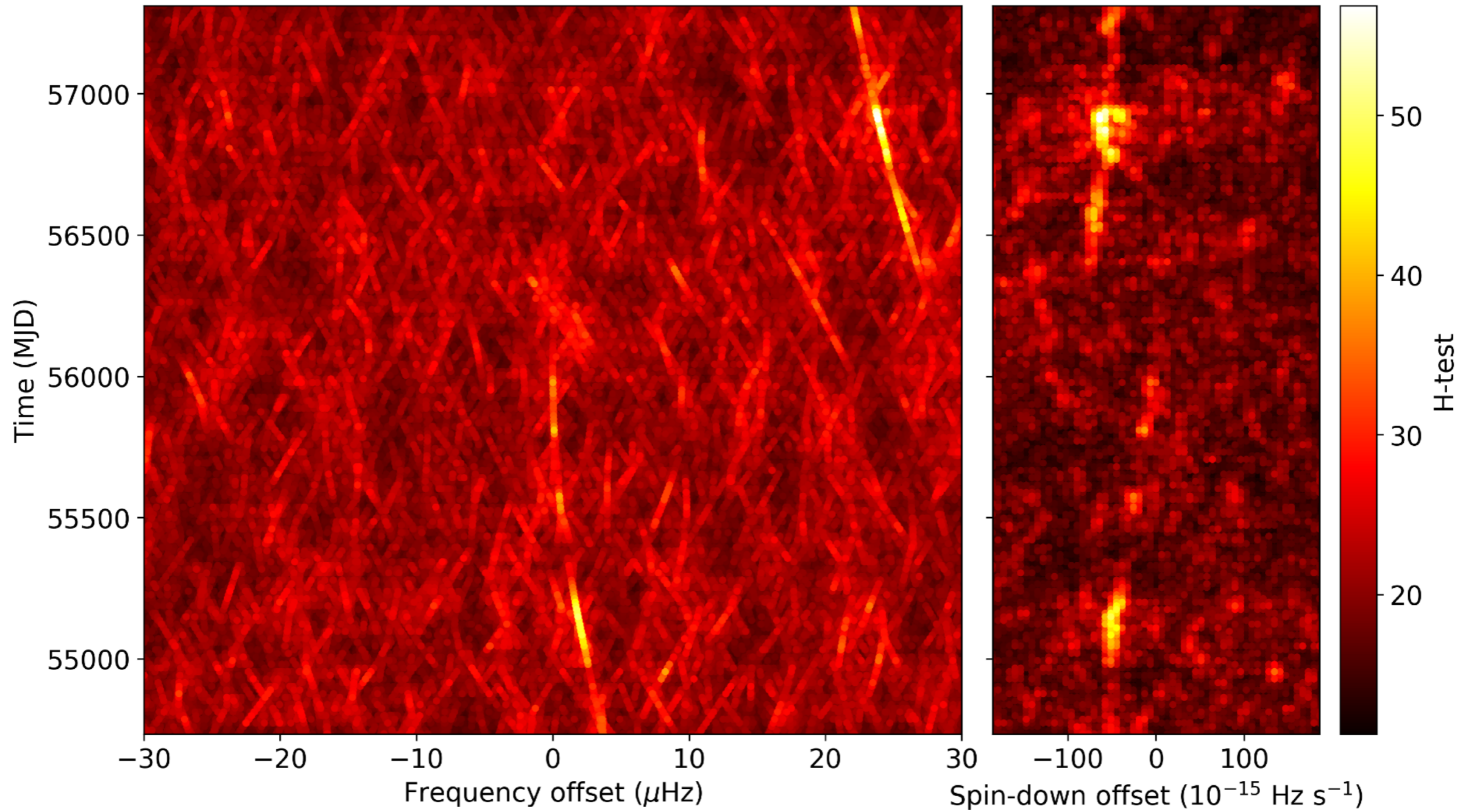
$$\dot{E} \sim 5 \times 10^{36} \text{ erg s}^{-1}$$

$$B_s \sim 2.5 \times 10^{12} \text{ G}$$

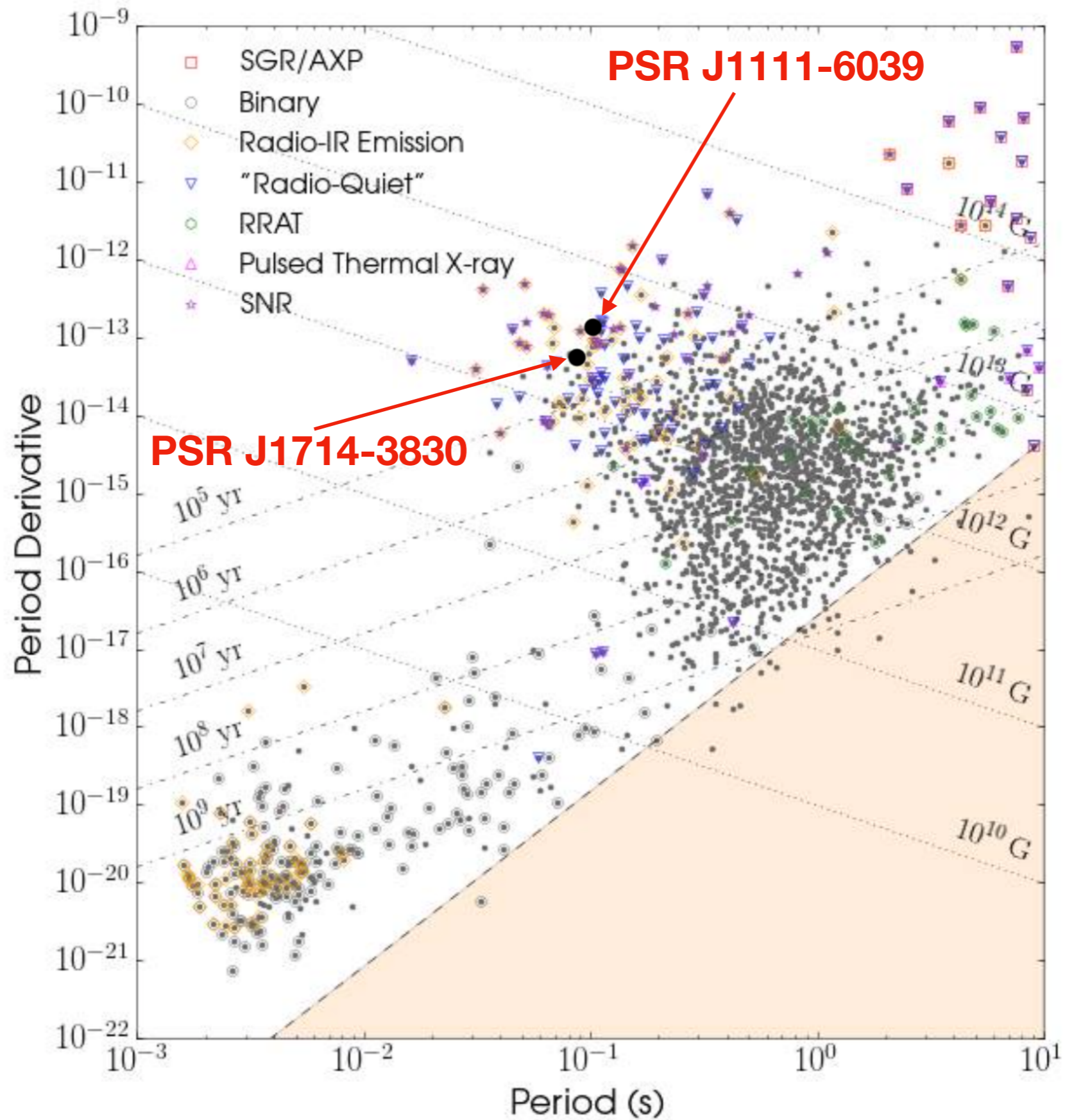
$$\tau \sim 20 \text{ kyr}$$



# Glitches in PSR J1714-3830



# The new pulsars



# Summary

- We have discovered two young, energetic gamma-ray pulsars powering SNRs
  - PSR J1111-6039 powering MSH 11-62
  - PSR J1714-3830 powering CTB 37A
- Both pulsars are highly significant in gamma rays but suffer from timing noise and glitches
- The pulsars show no radio pulsations
- A long (85 ks) *Chandra* observation of J1111-6039 failed to reveal X-ray pulsations
- Publication in prep.

# End of Talk Commercial



*galaxies*

Invitation to submit

Observations of Gamma - Ray Pulsars

**Guest Editor**  
Prof. Dr. Roberto Mignani

**Deadline**  
01 January 2019

**Special Issue**

- [http://www.mdpi.com/journal/galaxies/special\\_issues/Pulsars](http://www.mdpi.com/journal/galaxies/special_issues/Pulsars)