

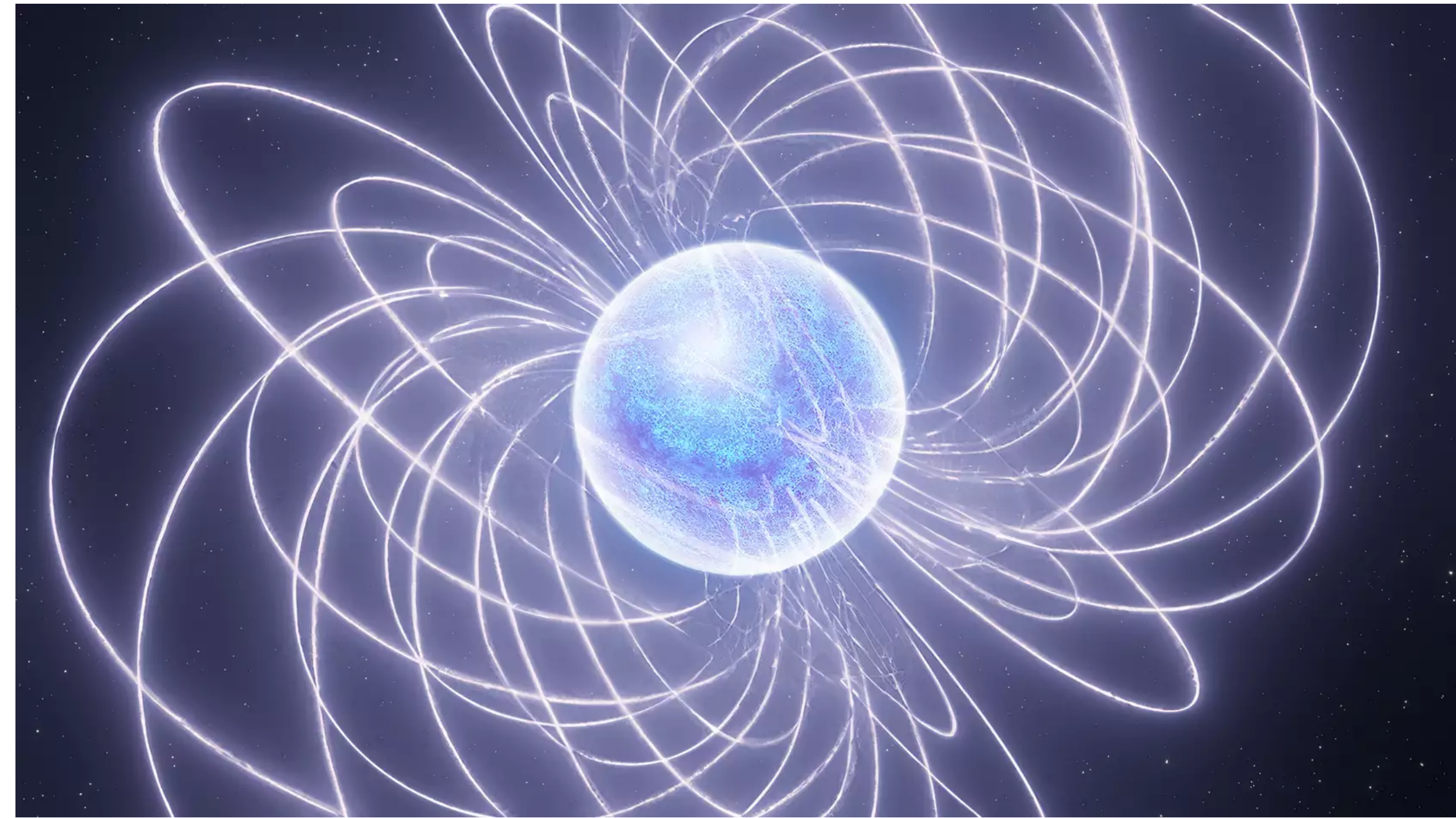
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# Quasi-periodic sub-pulse structure as a unifying feature for radio-emitting neutron stars

[Michael Kramer](#) , [Kuo Liu](#) , [Gregory Desvignes](#), [Ramesh Karuppusamy](#) & [Ben W. Stappers](#)

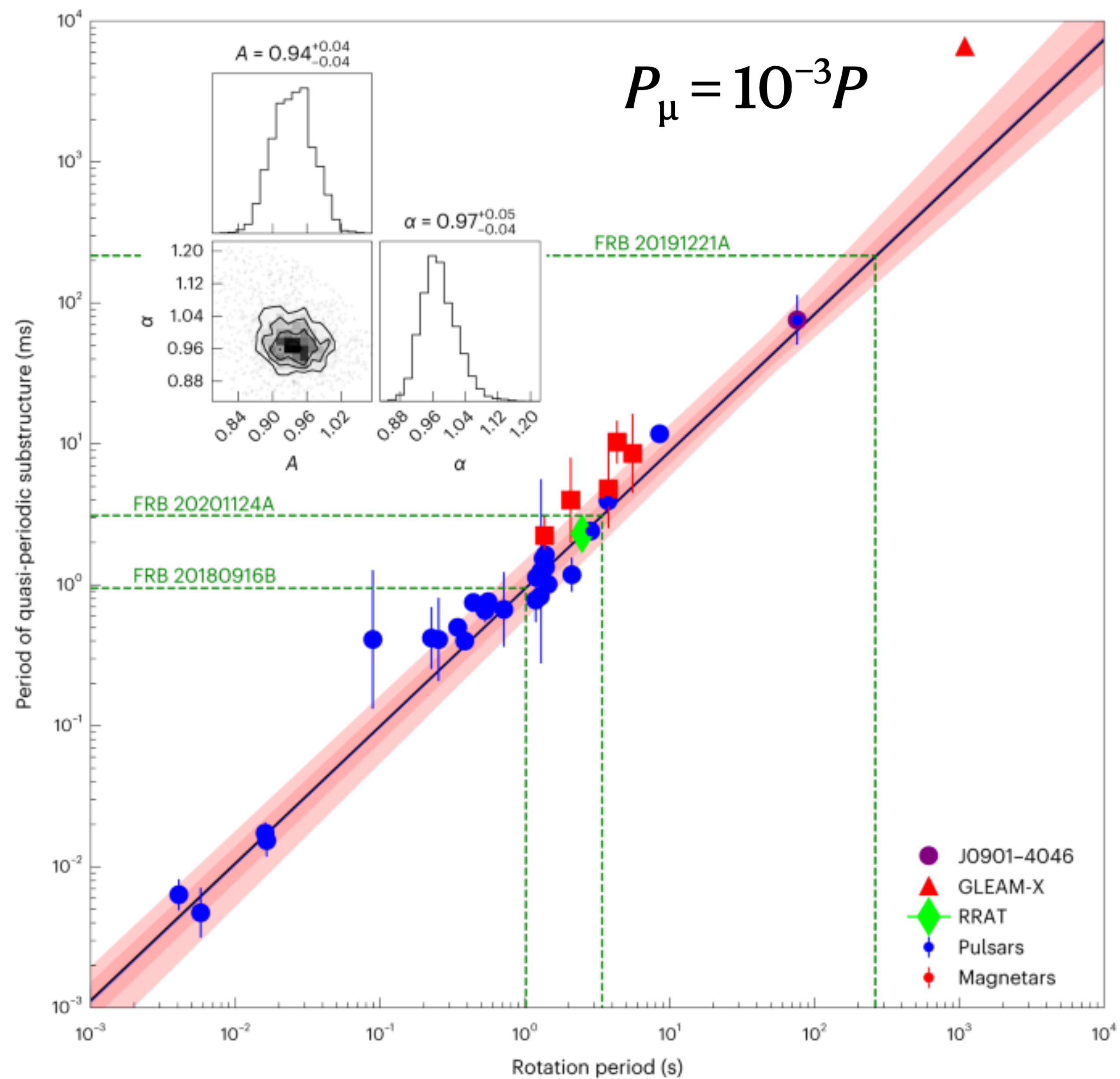
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## 射电脉冲的准周期子结构：各类中子星的统一特征



Presented by Xun Shi 石洵 at faculty journal club, SWIFAR 2024.03

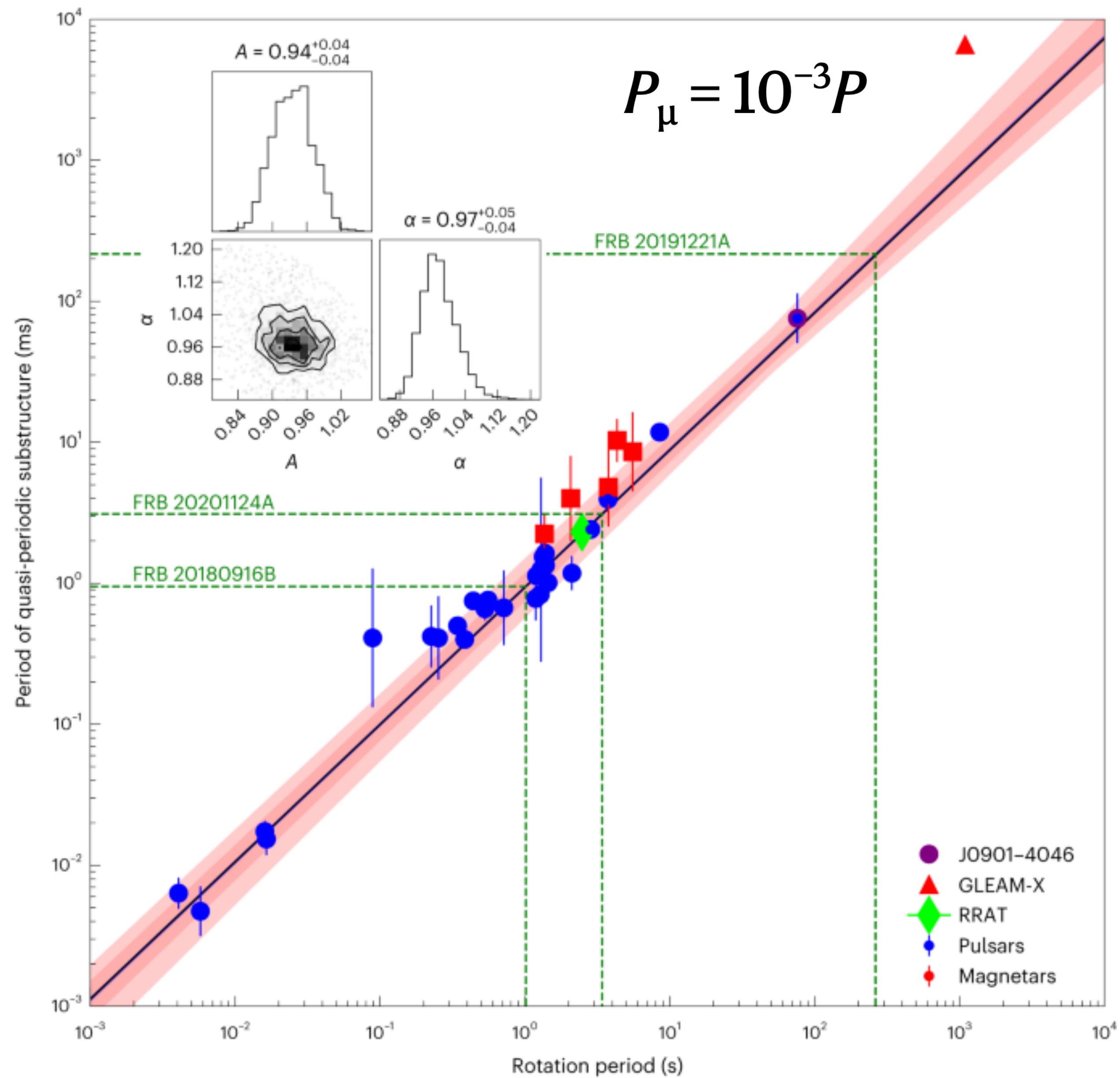
准周期子结构周期



中子星旋转周期



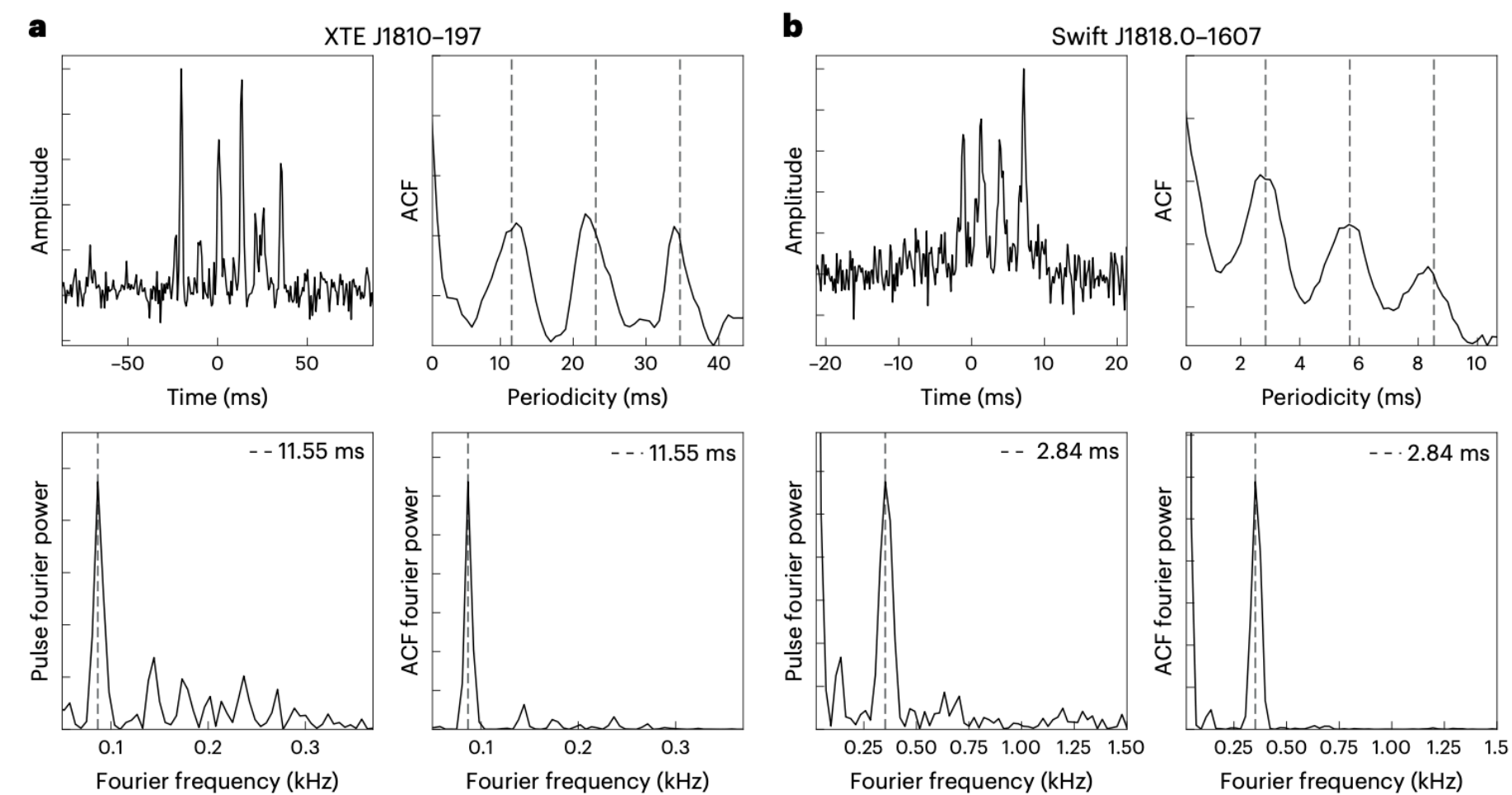
# 准周期子结构周期



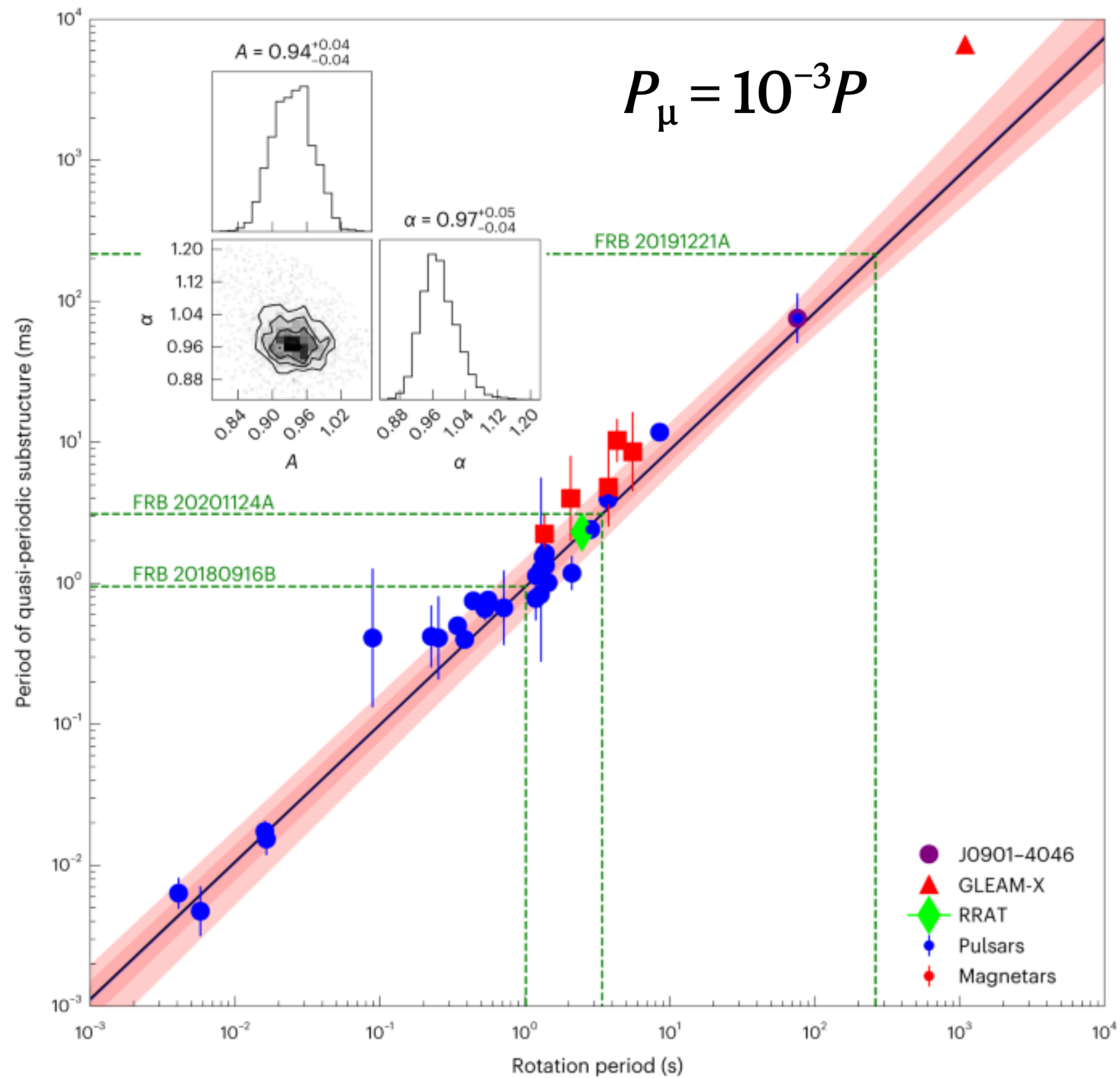
中子星旋转周期

- What are the “quasi-periodic substructures”

Examples of quasi-periodic substructure from magnetars



# 准周期子结构周期

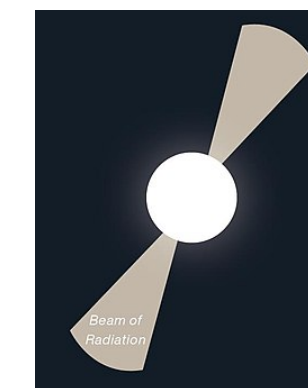


中子星旋转周期

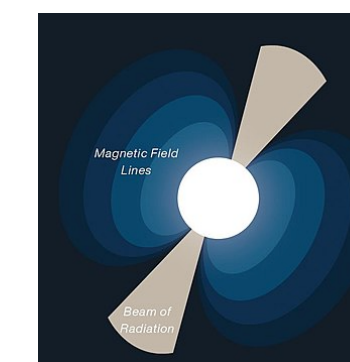
## What are the data points?



Pulsars



Magnetars (+ pulsar)



RRAT

**Rotating radio transients** sourced by subset of rotating neutron stars that emit radio pulses sporadically

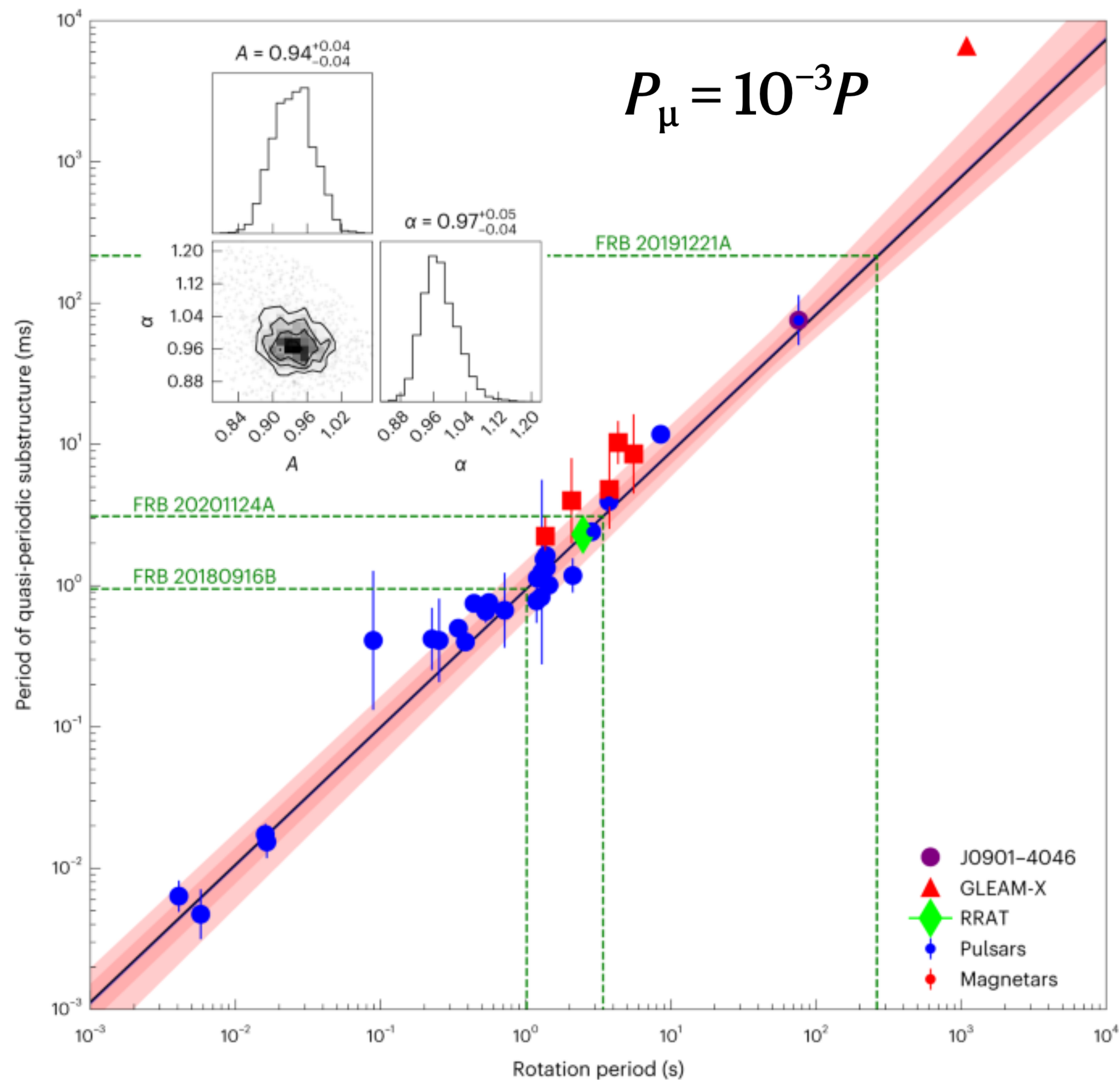


J0901-4046 P=76s pulsar



GLEAM-X ultra-long-period old magnetar with P=1090s

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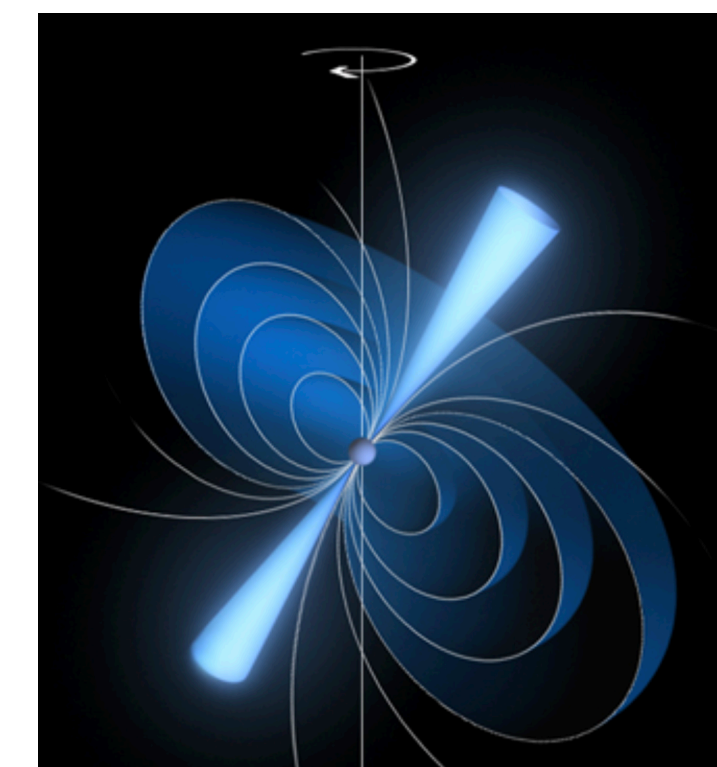
中子星旋转周期

• What's the significance of this relation?

A relation across many orders of magnitudes (>5)

Intrinsic origin of the subpulse structure must be the same for all radio-loud neutron stars

Reveals information about the plasma process responsible for the radio emission

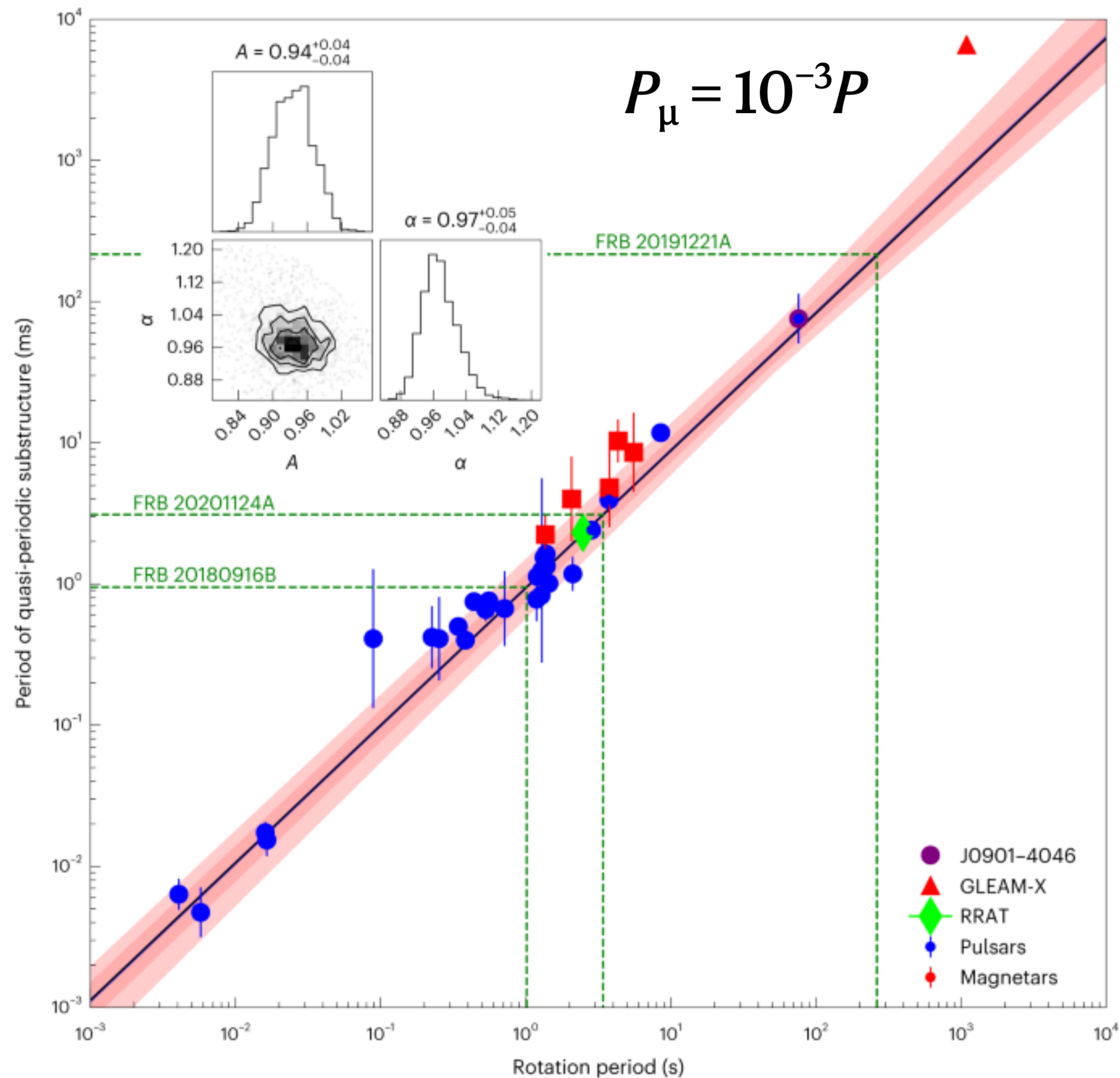


Pulsar radio emission mechanism: still no consensus

Is this correlation expected?



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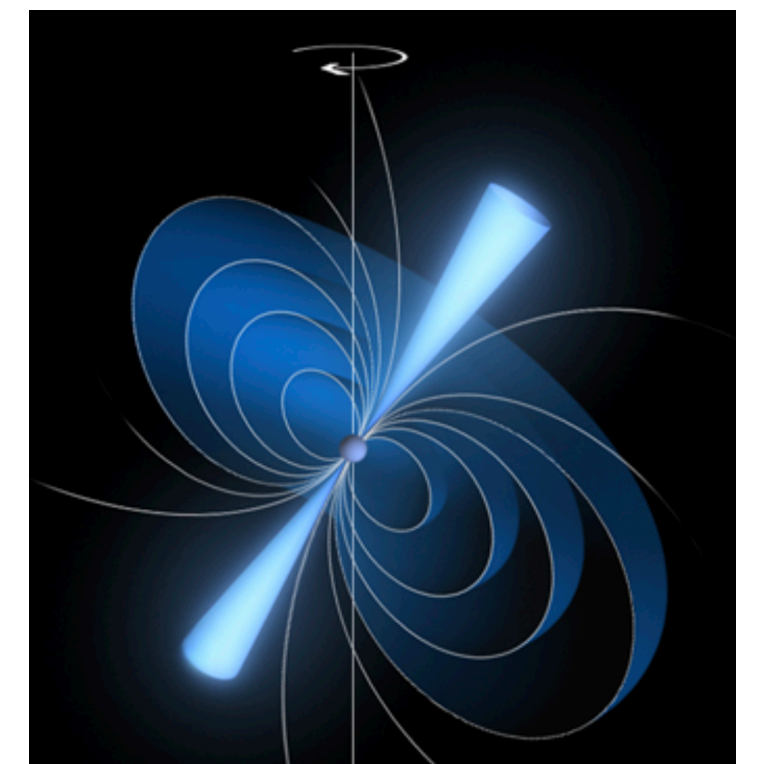
# 中子星旋转周期

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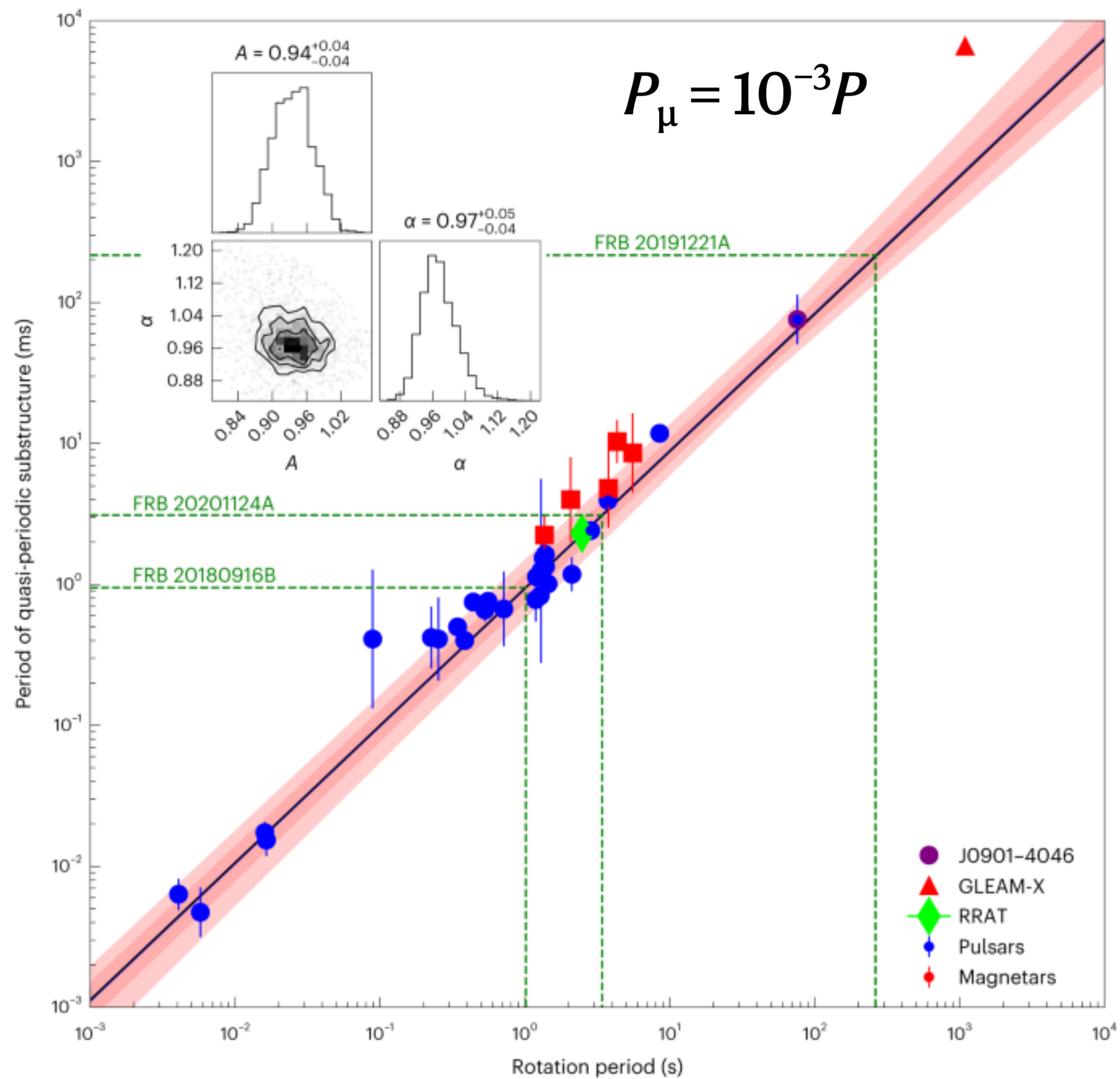
Reveals information about the plasma process responsible for the radio emission



Pulsar radio emission mechanism: still no consensus

**Is this correlation expected?** Not really. Magnetars powered by magnetic field energy, others powered by rotational energy; Some are very old, some are very young.

准周期子结构周期



中子星旋转周期

- Possible application of this relation?

Infer underlying rotational periods from FRBs?

Because:

FRBs can be magnetars (energetic; example of SGR J1935+2154);

Although periodicity has not been discovered for FRBs, quasi-periodic substructures are



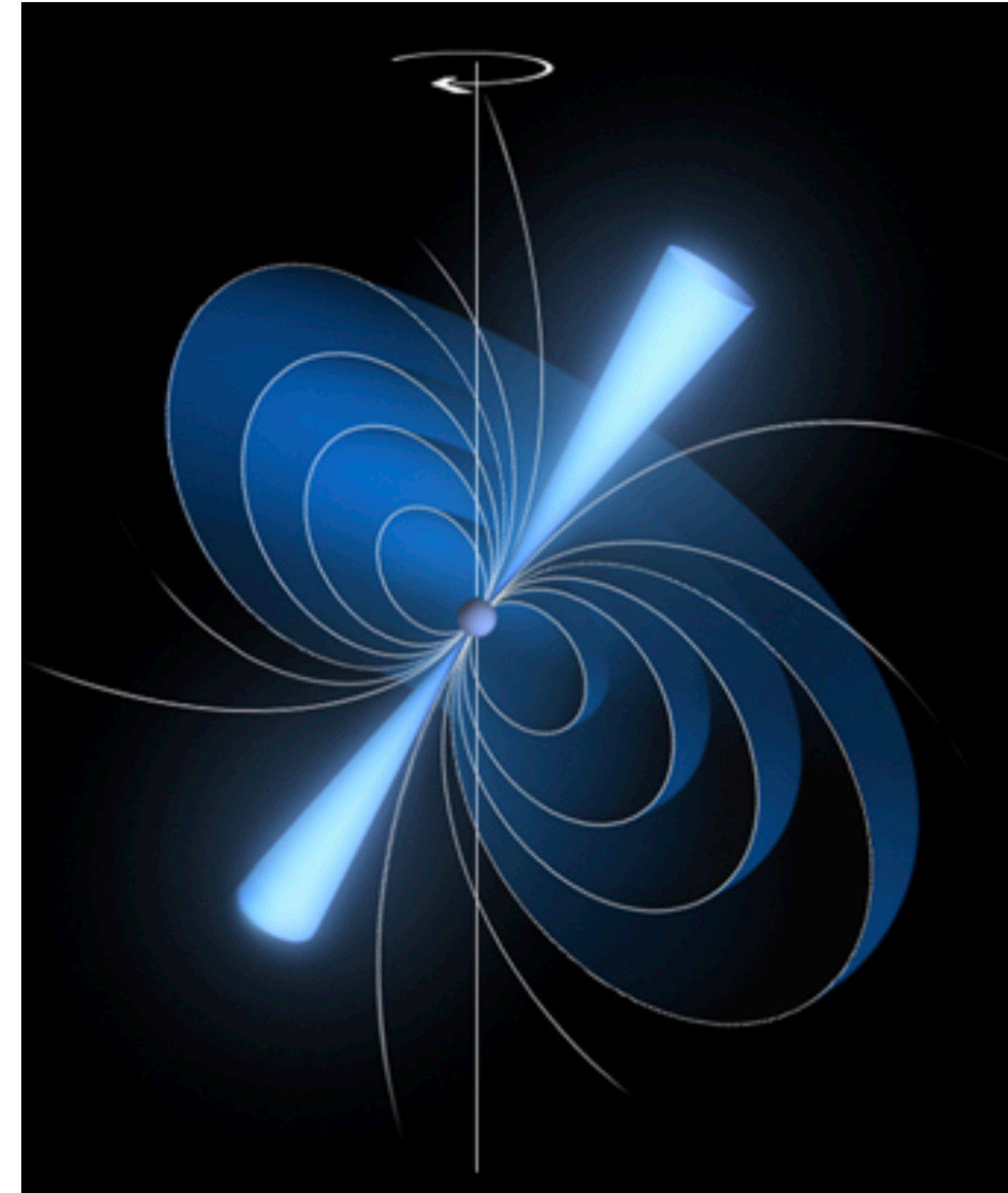


# Pulsar radio emission mechanism: still no consensus

Relativistic charged particles  
+ Magnetic fields

But in detail:

coherent curvature emission (CCE) or  
relativistic plasma emission (RPE) or  
anomalous Doppler emission (ADE) or  
linear acceleration emission (LAE) or  
free-electron maser emission (FEM) or  
... ???



# Classes of Neutron Stars

Neutron star P-Pdot diagram

