

Pulsar Timing with single pulses

Siyuan Chen (陈思源)

Shanghai Astronomical
Observatory, CAS

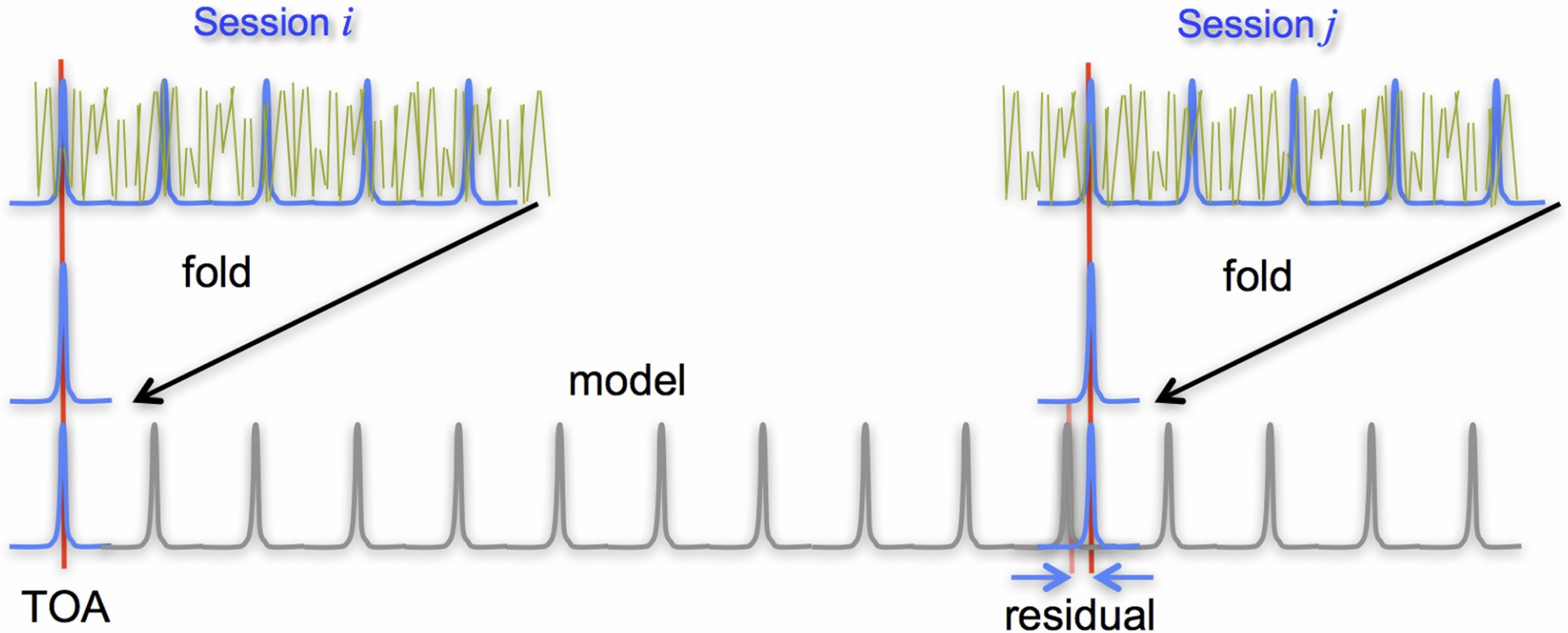
14/05/2025
Guizhou, China



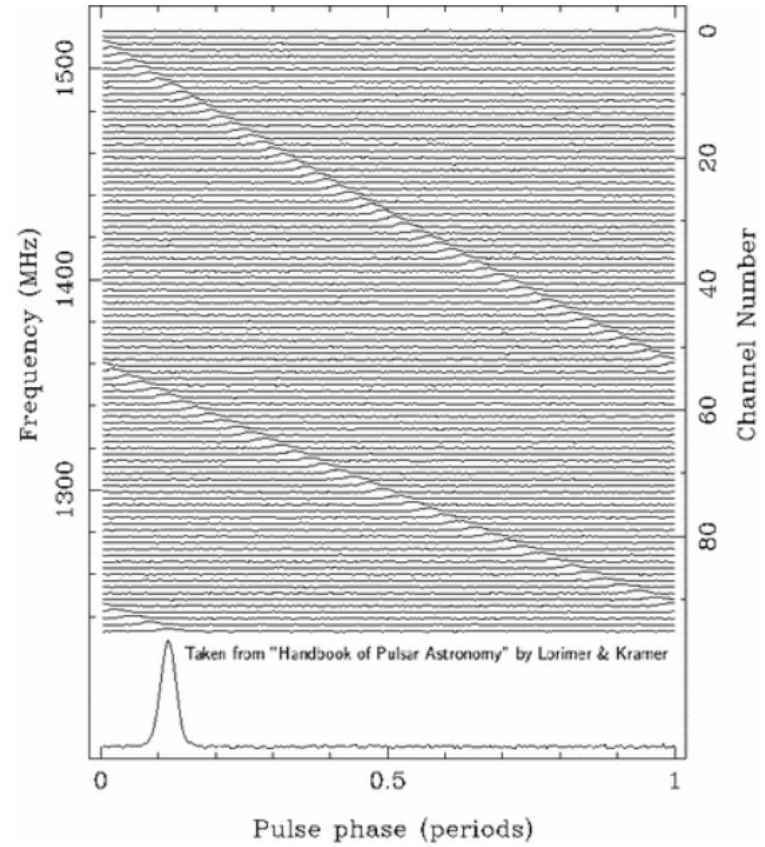
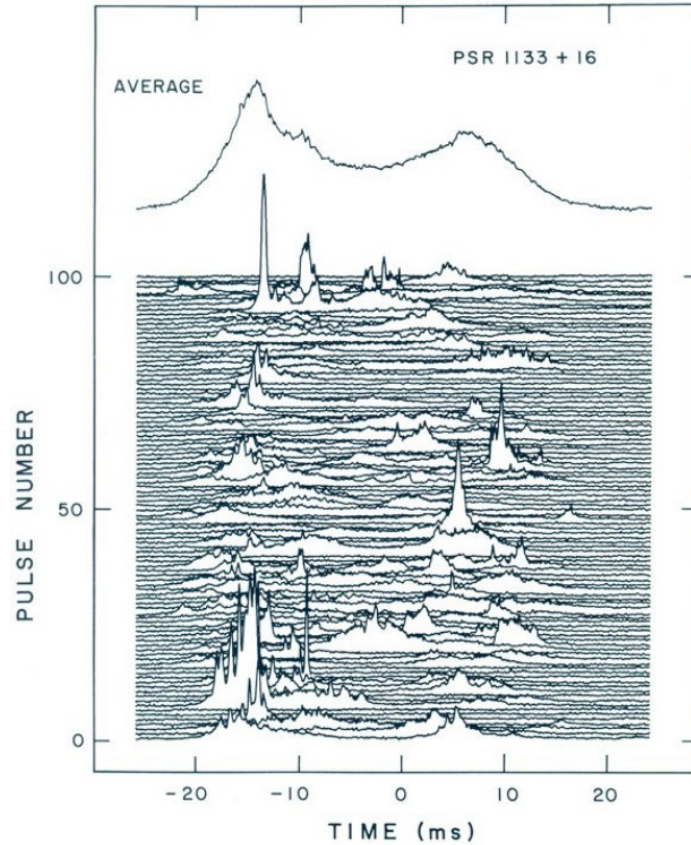
Standard pulsar timing

Phase-connected timing solution:

Credit: D. Champion

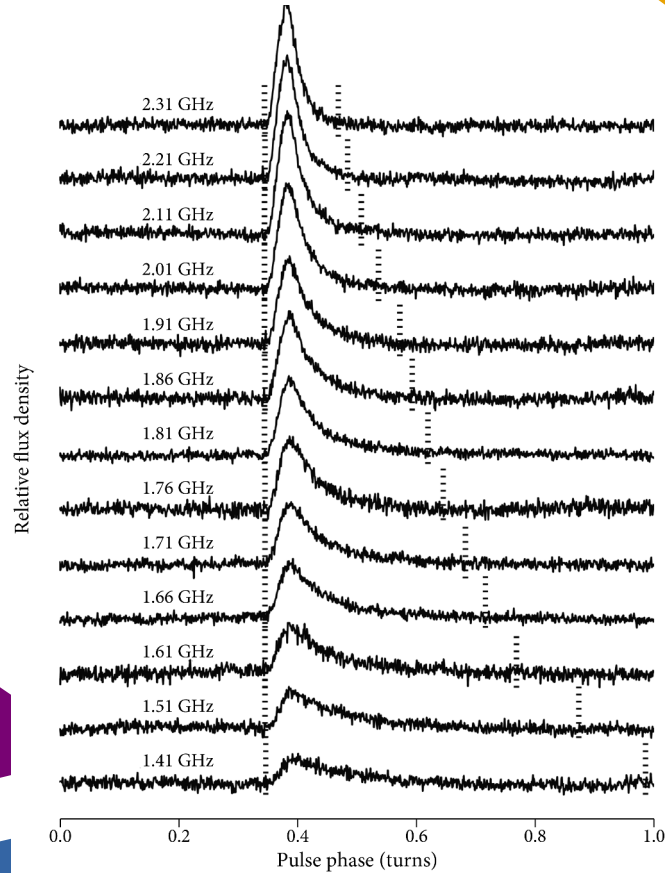


Possible issues



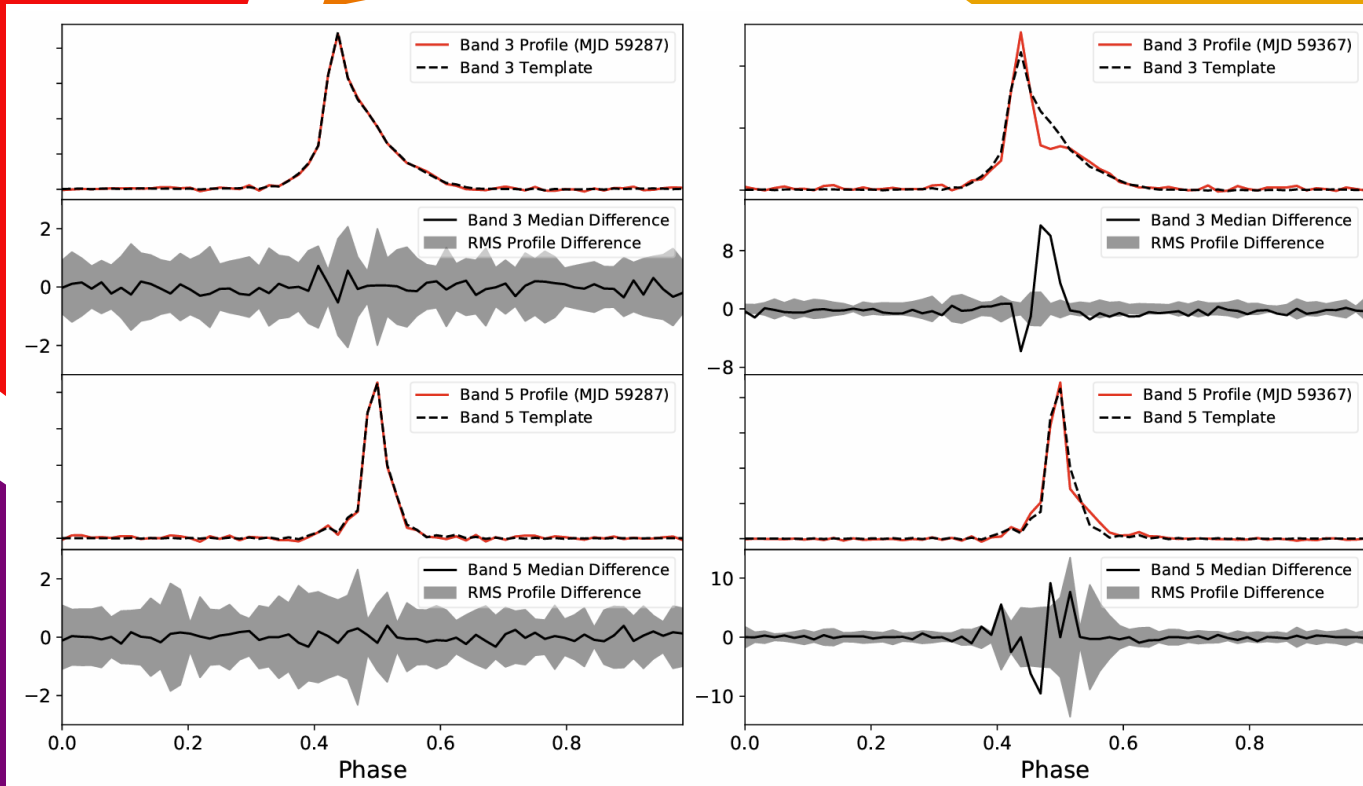
Possible issues

J1745-2900



Pennucci et al. 2015

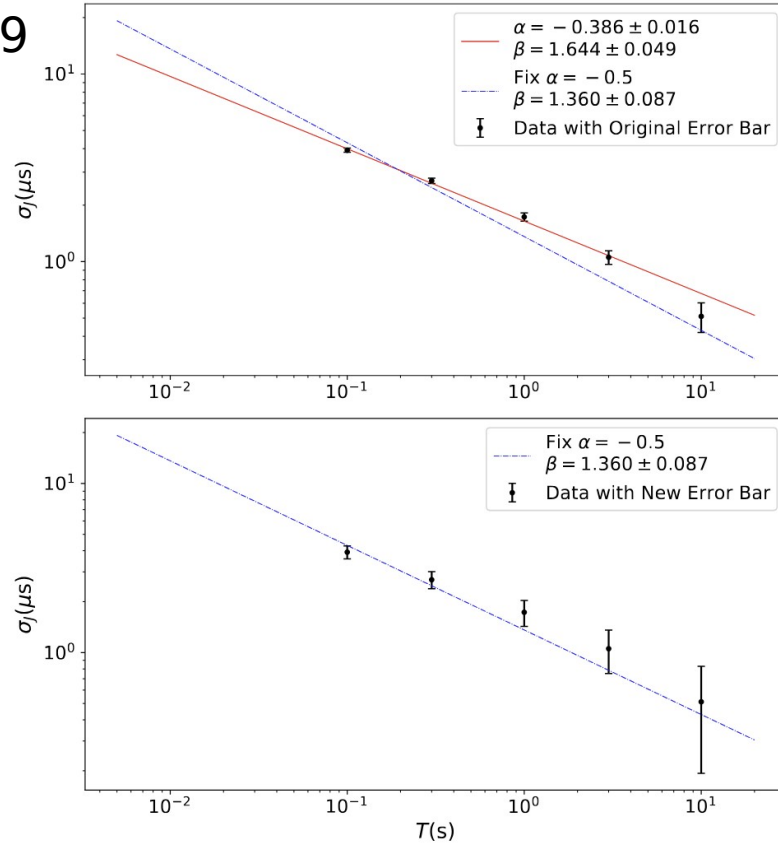
Possible issues



Singha et al., 2021
See also Lam et al., 2021; 5
Xu et al., 2021, etc.

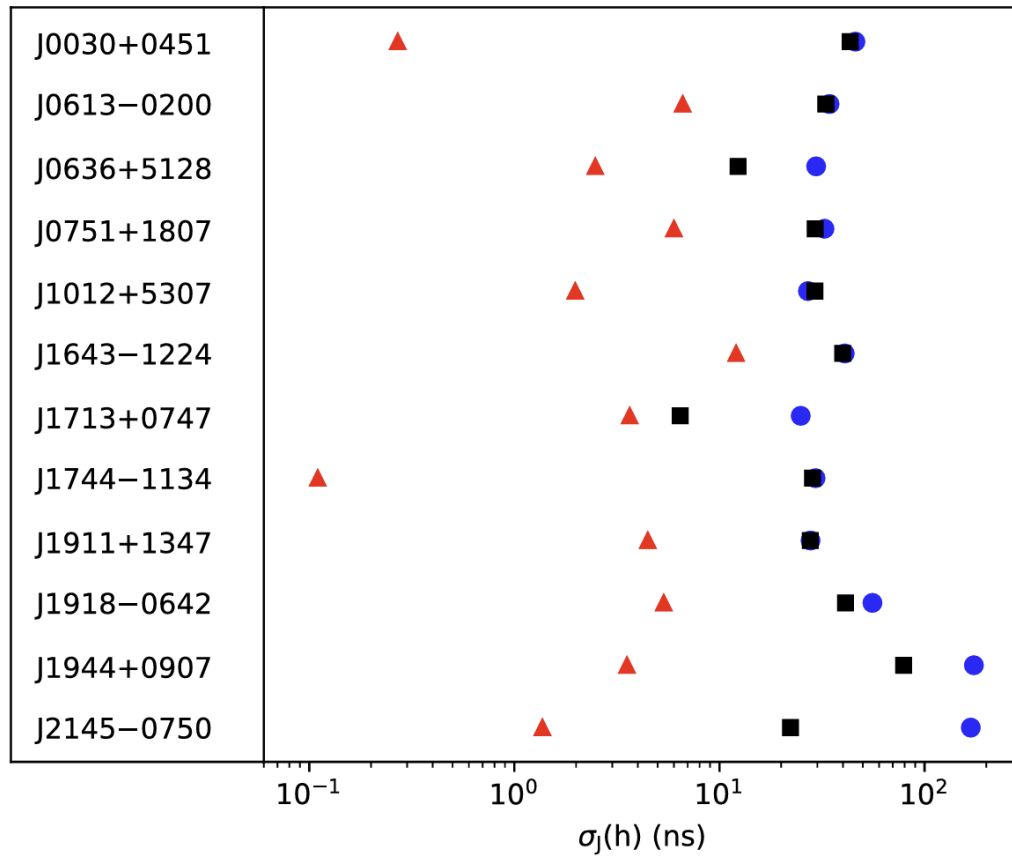
Pulse jitter

J0406+3039



Wang et al., in prep.

Pulse jitter

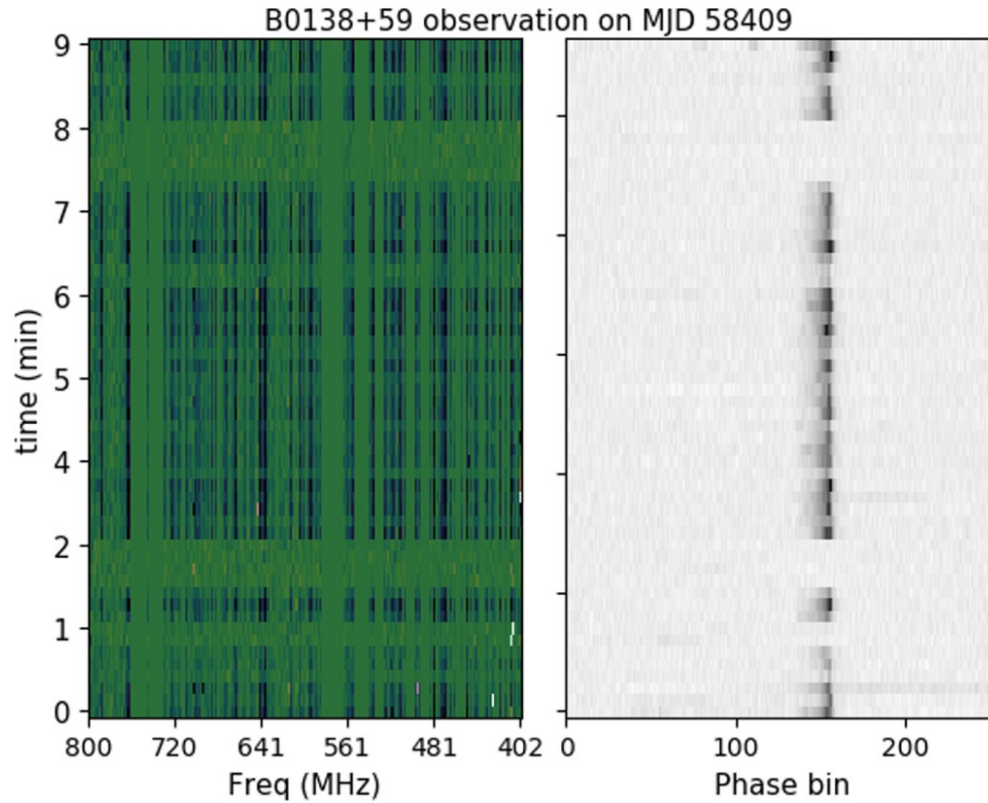


Wang et al., 2024

New phenomena

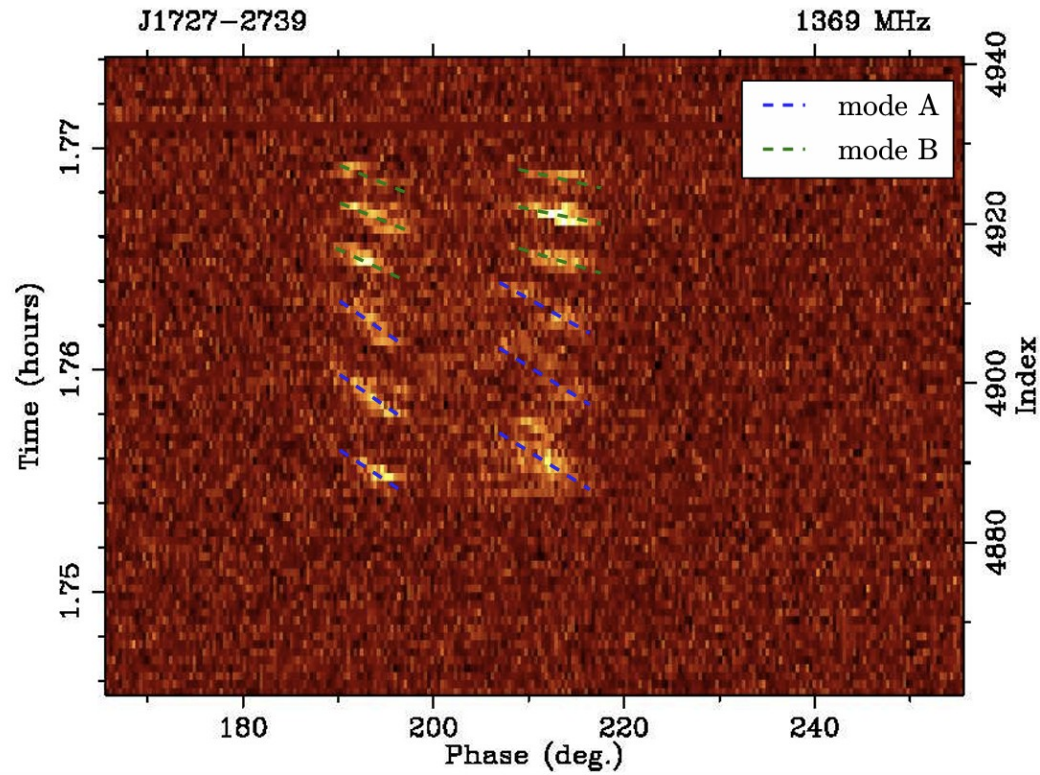
- High S/N single pulse observations from e.g., FAST, other telescopes
- Nulling
- Subpulse drifting
- Mode changes
- Giant pulses

Nulling



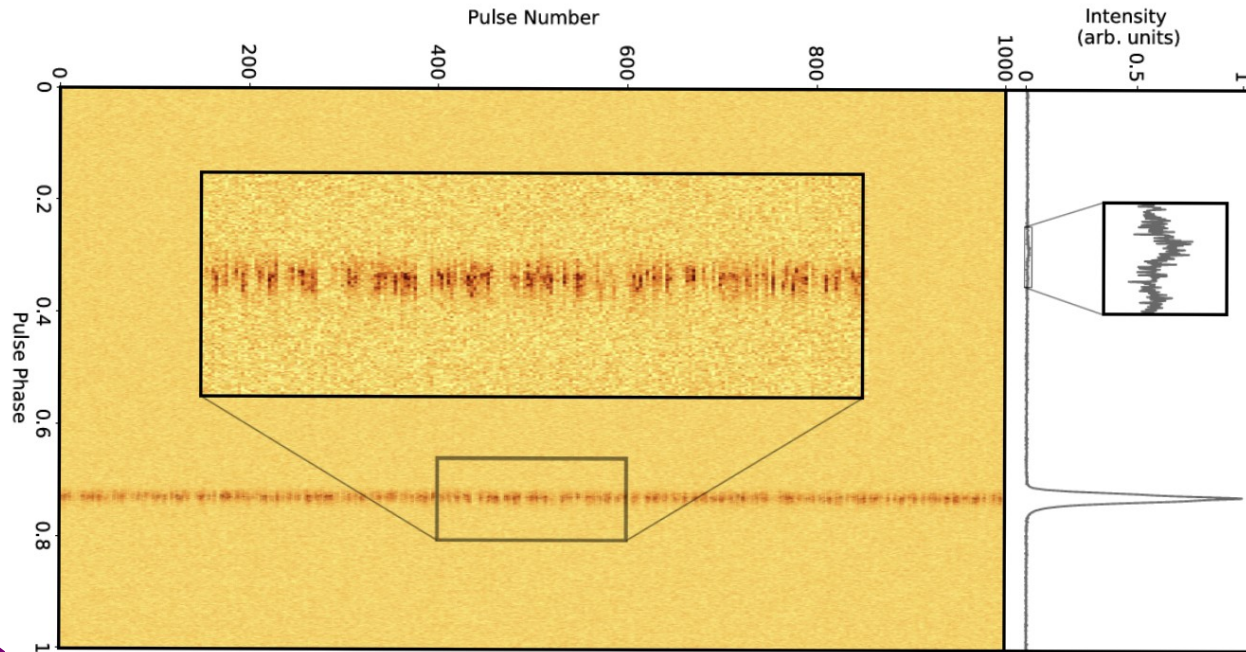
Ng et al. 2020

Subpulse drifting



Rejep et al. 2021

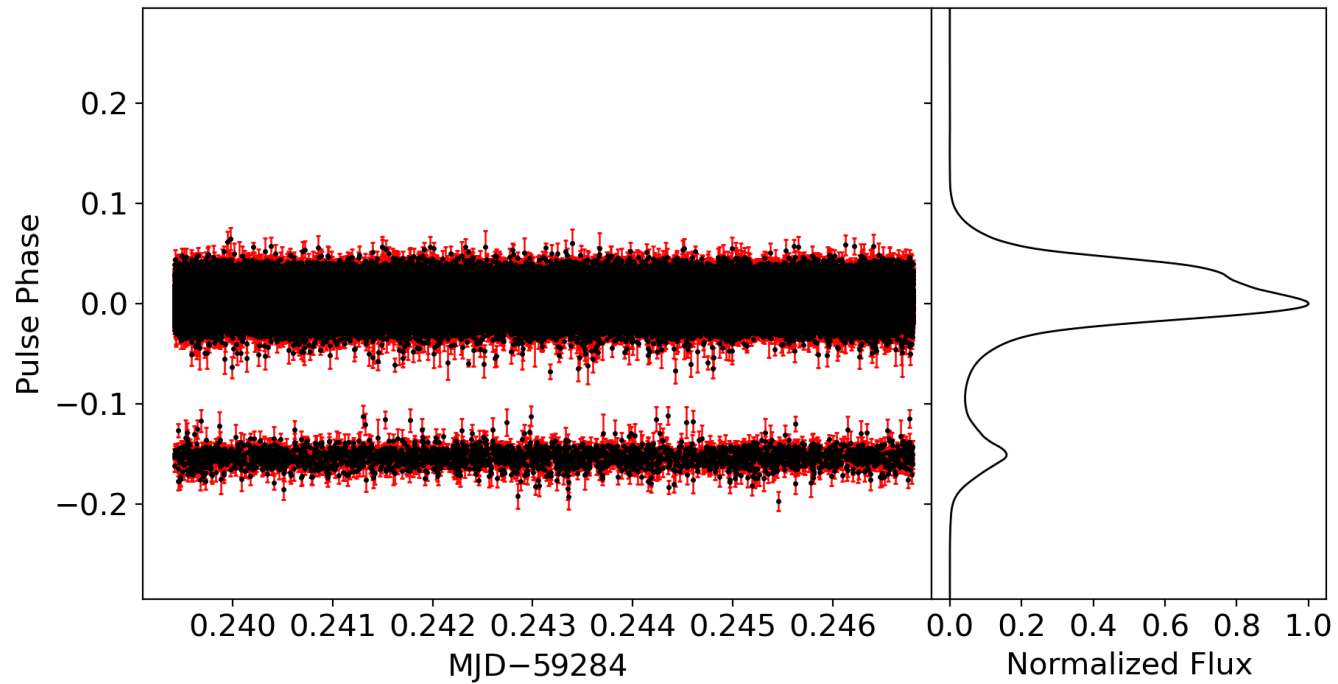
Mode changes



J1909-3744

Miles et al. 2021

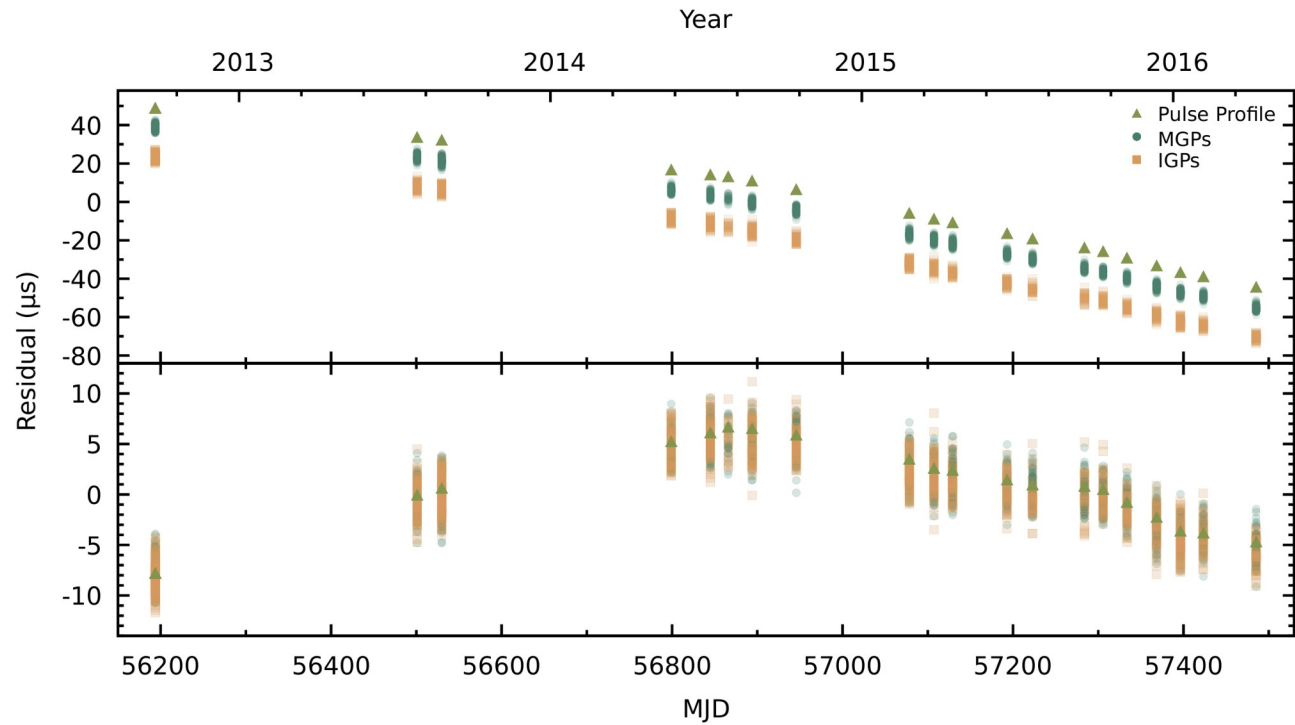
Mode changes



J10023+0923

Wang et al., in prep.

Giant pulses



B1937+21

McKee et al., 2018

Summary

- Standard pulsar timing assumes that integrating over a sufficient number of pulses result in a stable pulse profile; and thus we are limited only by the pulse jitter
- Various issues with the standard assumption: Mode changes averaged together, extra noise from nulling added, subpulse drifting, etc.

**Do we have any chance of using FRBs
for timing?**