Period variations in RRc KIC5520878

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Lyrae

The lyre (λύρα, lýra) is a string instrument known for its use in Greek classical antiquity

New idea for SETI

Learned et. al. proposed that a sufficiently advanced extra-terrestrial civilization may tickle Cepheid and Lyrae variable stars with a neutrino beam at the right time, thus causing them to trigger early and jogging the otherwise very regular phase of their expansion and contraction. This would turn these stars into beacons to transmit information throughout the galaxy and beyond. The idea is to search for signs of phase modulation (in the regime of short pulse duration) and patterns, which could be indicative of intentional signaling.

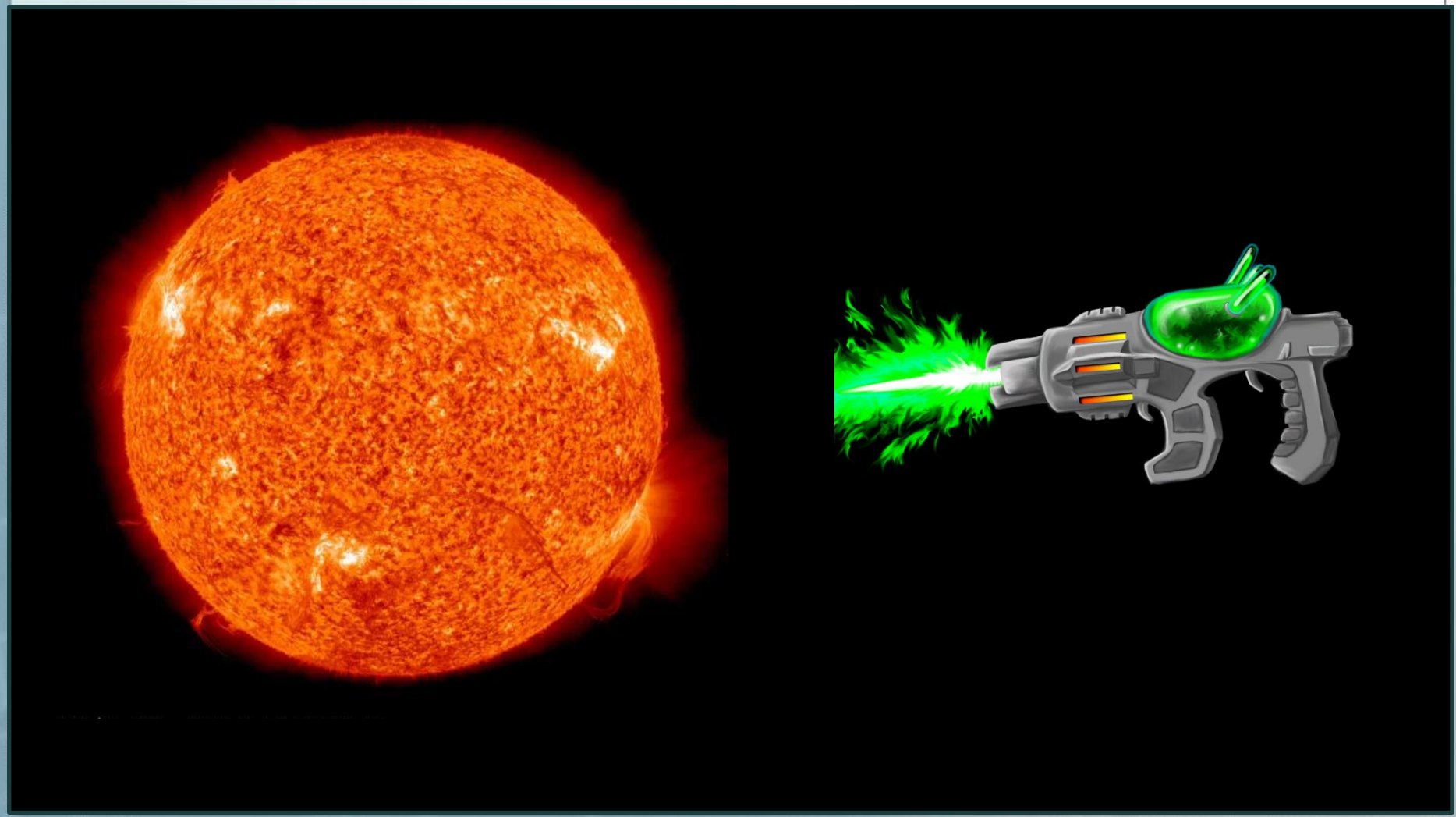
John G. Learned. R-P. Kudritzki. Sandip Pakvasa. and A. Zee

in

The Cepheid Galactic Internet

arXiv:0809.0339v2

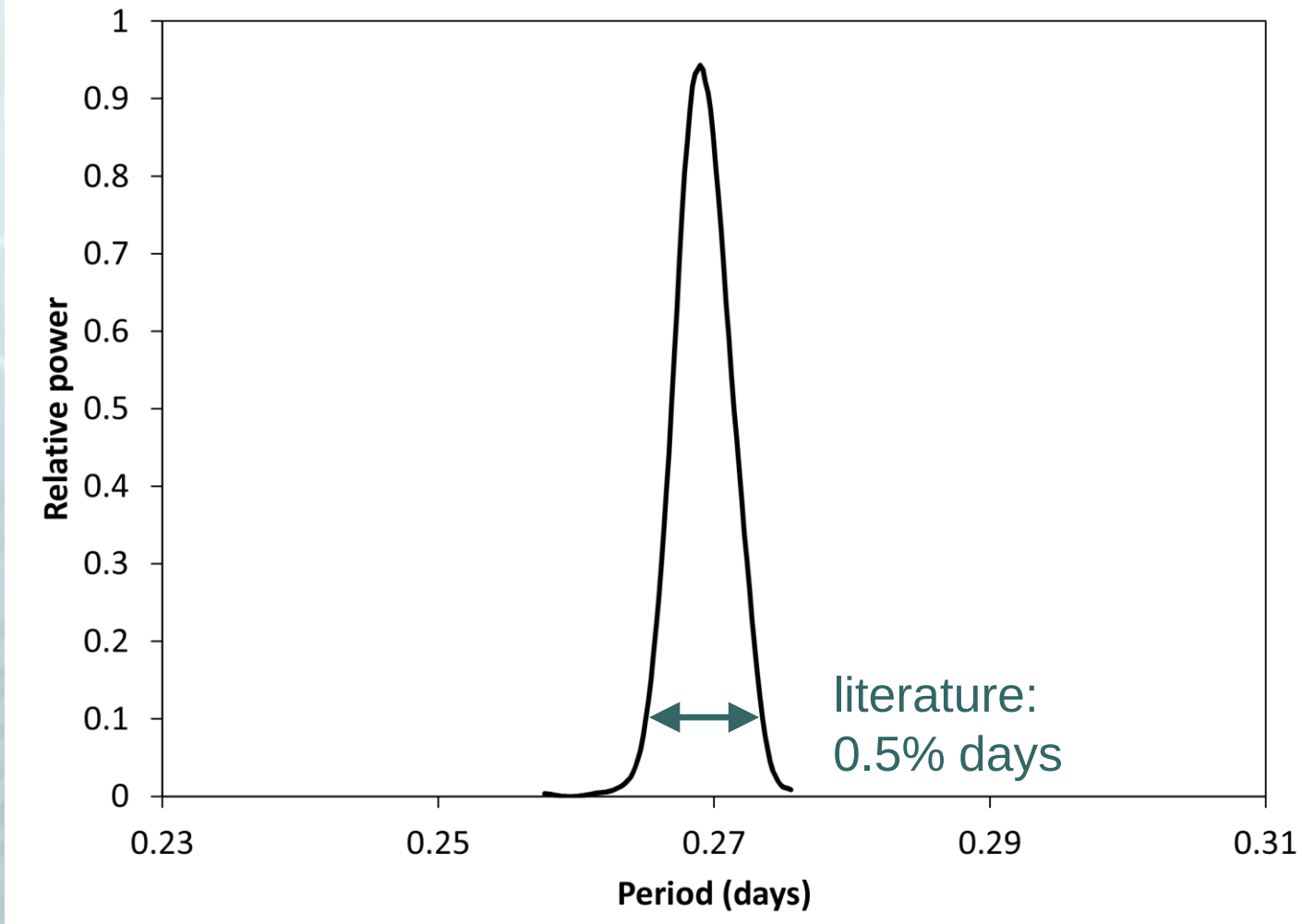
(not to scale)



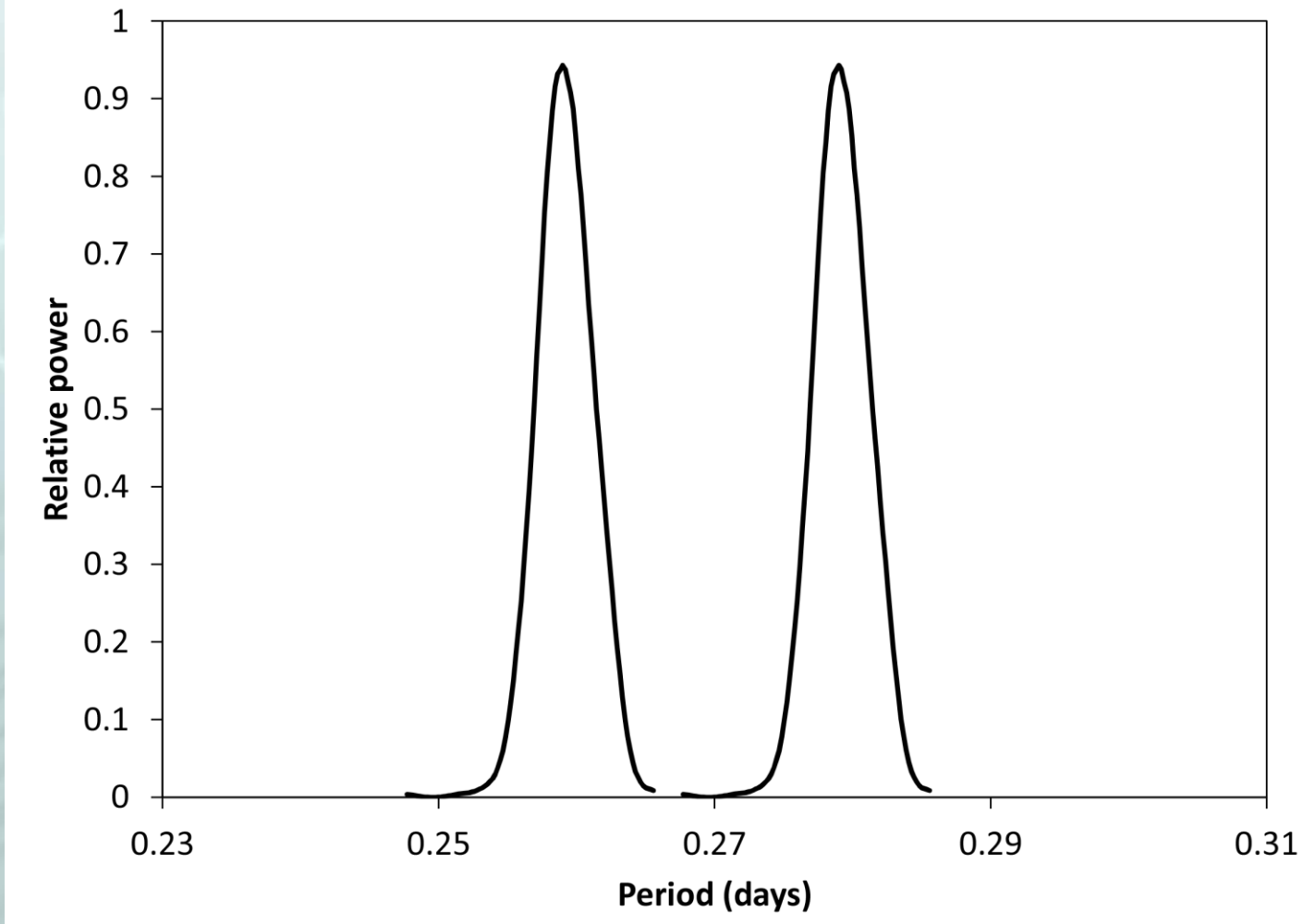
Data search is now possible

- Goal: Uninterrupted period lengths over long timescales (months, years)
- Earth-bound data is sparsely sampled (day/night, weather)
- Data from the *Kepler* spacecraft is of good quality and continuity (~99% duty cycle)
- A first test was done with the only Cepheid in the (original) Kepler field of view, V1154Cyg. It shows only slight period variations
- Following analysis was done with the 43 Lyrae stars in the Kepler field of view (Nemec et. al. 2013)
- RRc Lyrae star KIC5520878 shows large period variations (~20%) with non-random pattern

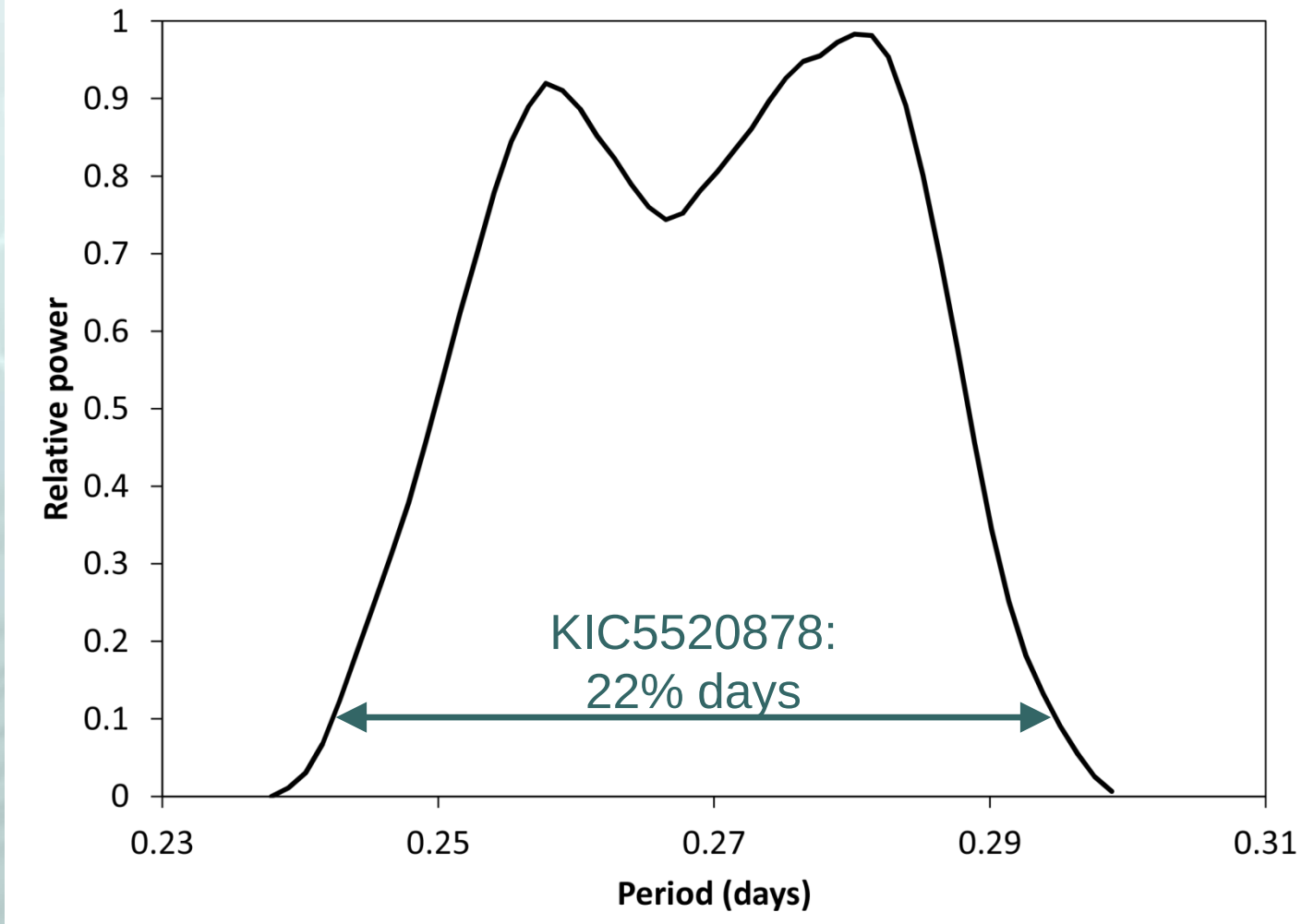
What we expected from RR Lyrae



Learned et al. hypothesis



What we found



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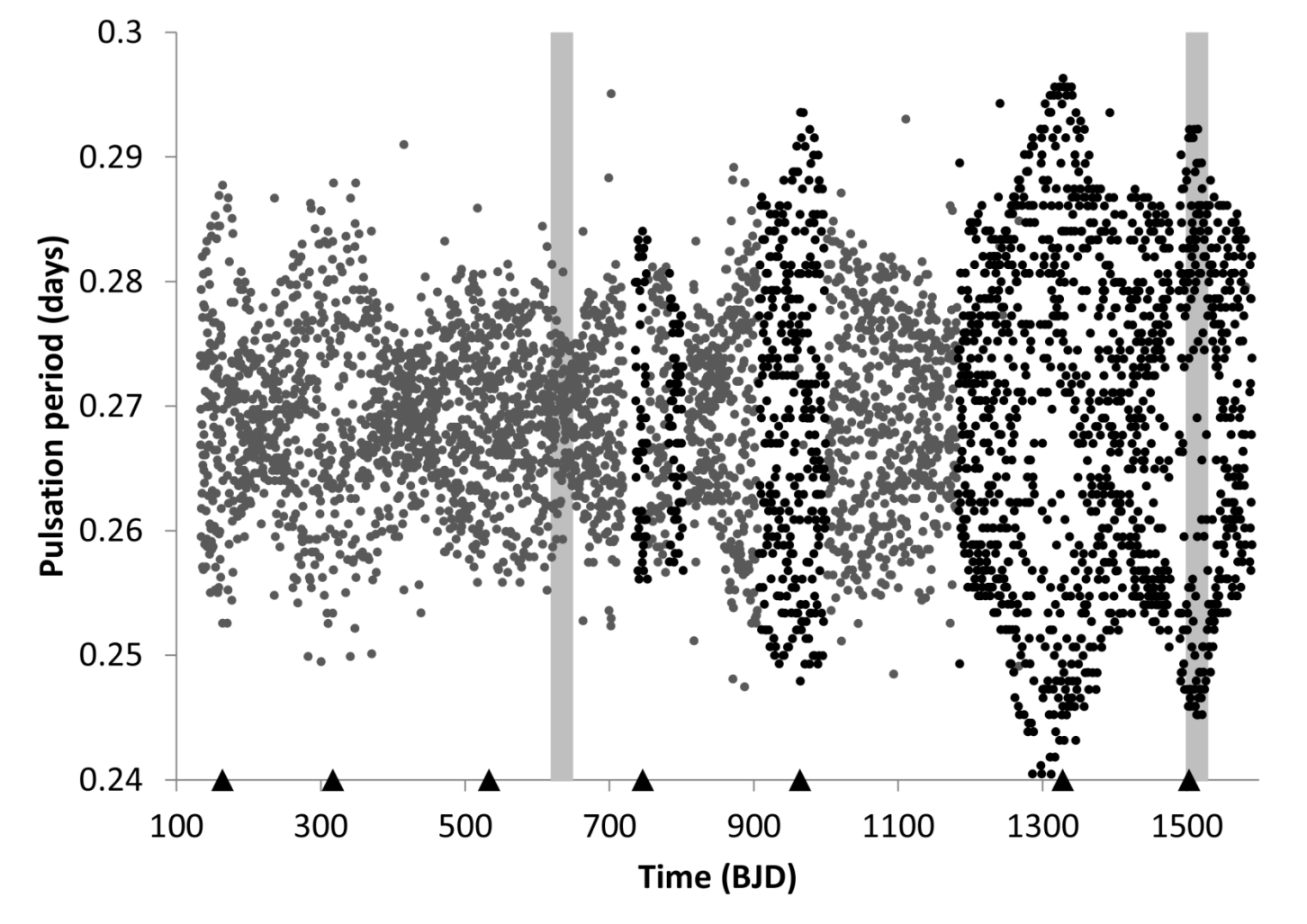
Behnam Kia

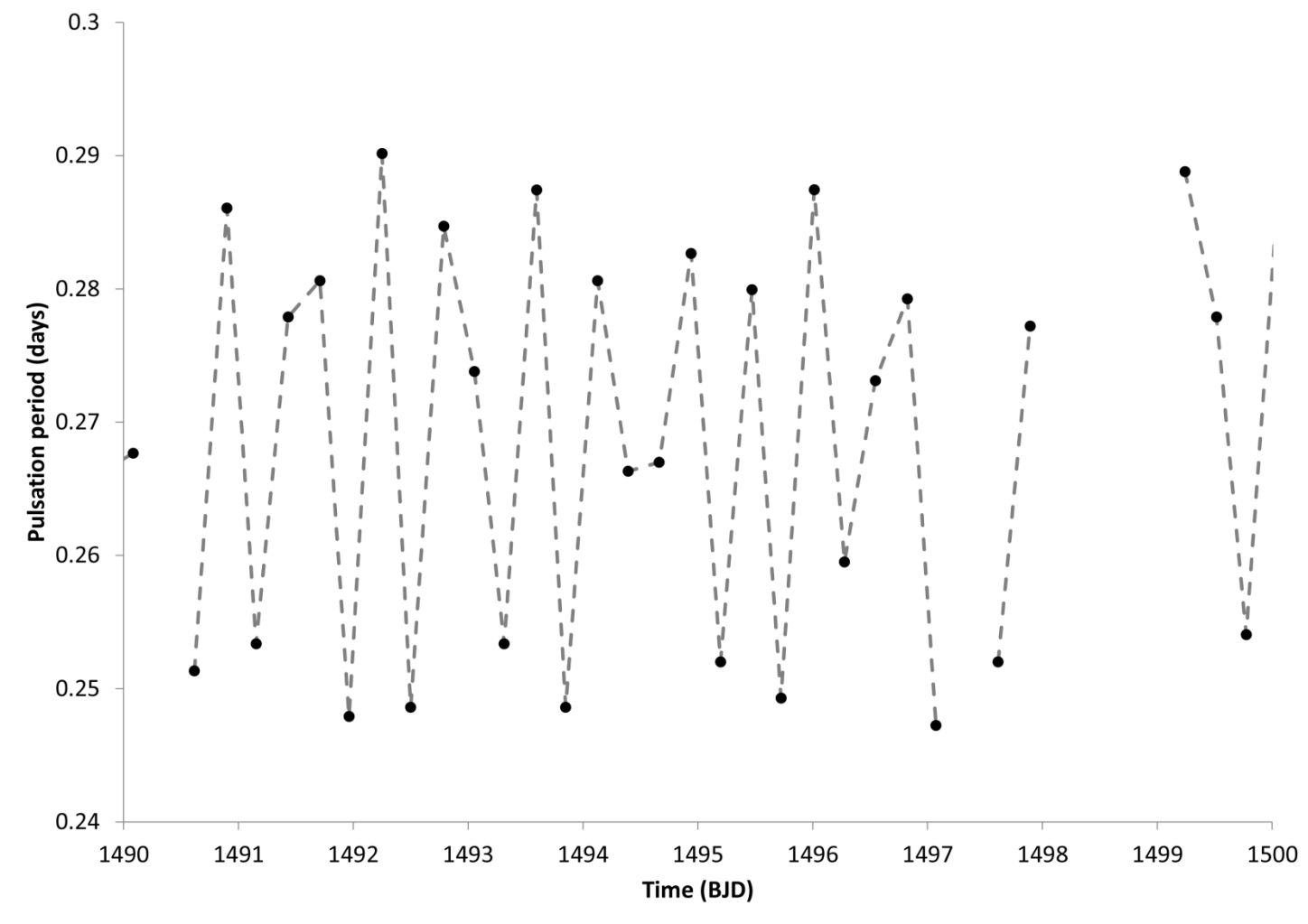
William Ditto

Ian Stevens

Period lengths over 3yrs



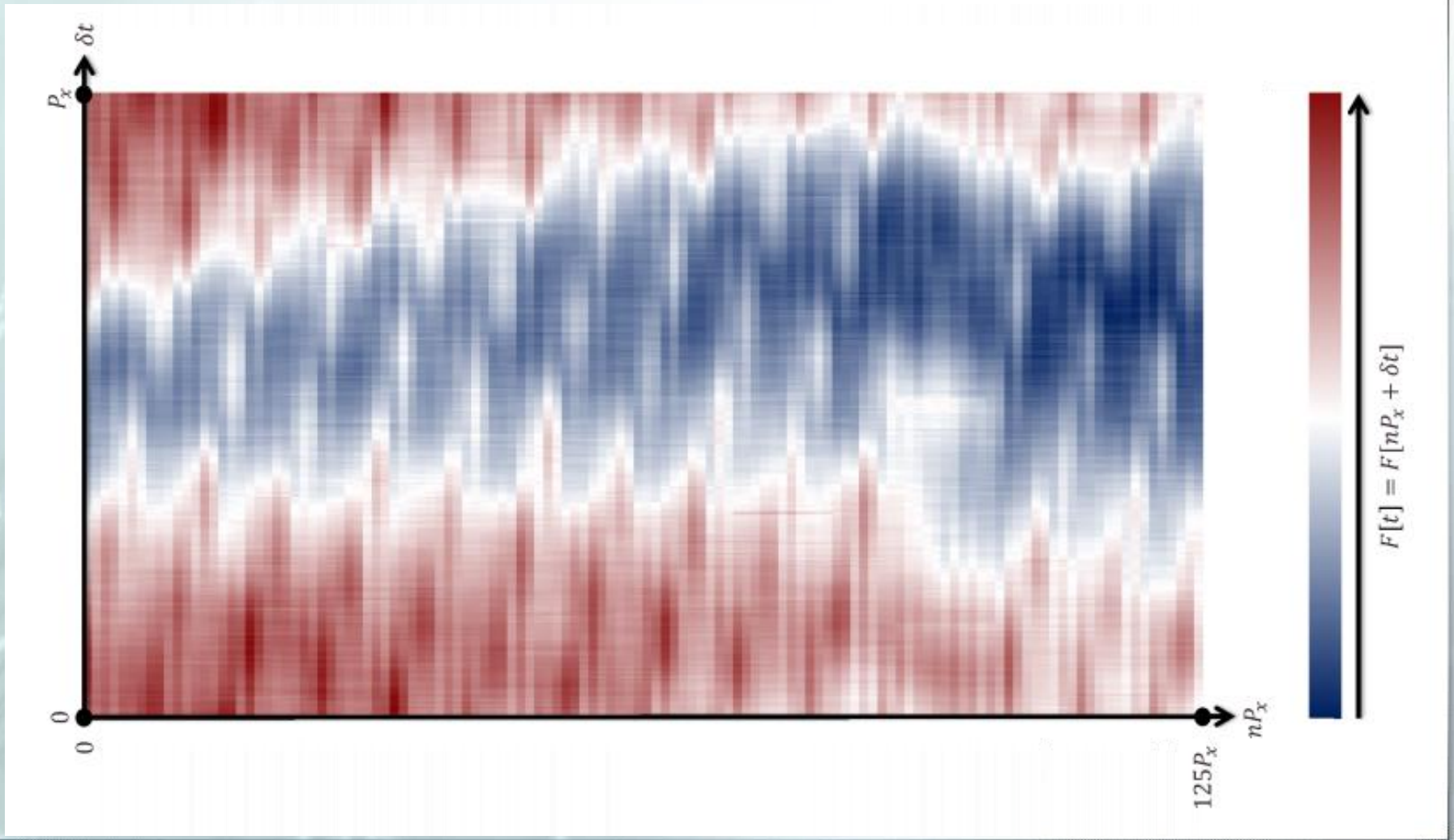
Period lengths over 10 days



Disentangle the periods

- When looking at the frequencies, we see:
  - The main pulsation f_1 (0.27 days)
  - Its multiples
  - Secondary pulsation f_X
  - Multiples of f_1 and f_X as well as $f_1 + f_X$ etc.
- We can fit sines, simultanously, to all (significant) frequencies but f_X itself and subtract them („pre-whitening“) [here be dragons]
- Ideally, the result will give the pure view of f_X, which be think causes the funny modulation
- To cause a varying modulation, f_X cannot be a constant sine.
  But what does it look like?

Amplitude of P_x over time



More of it in Vivek‘s talk