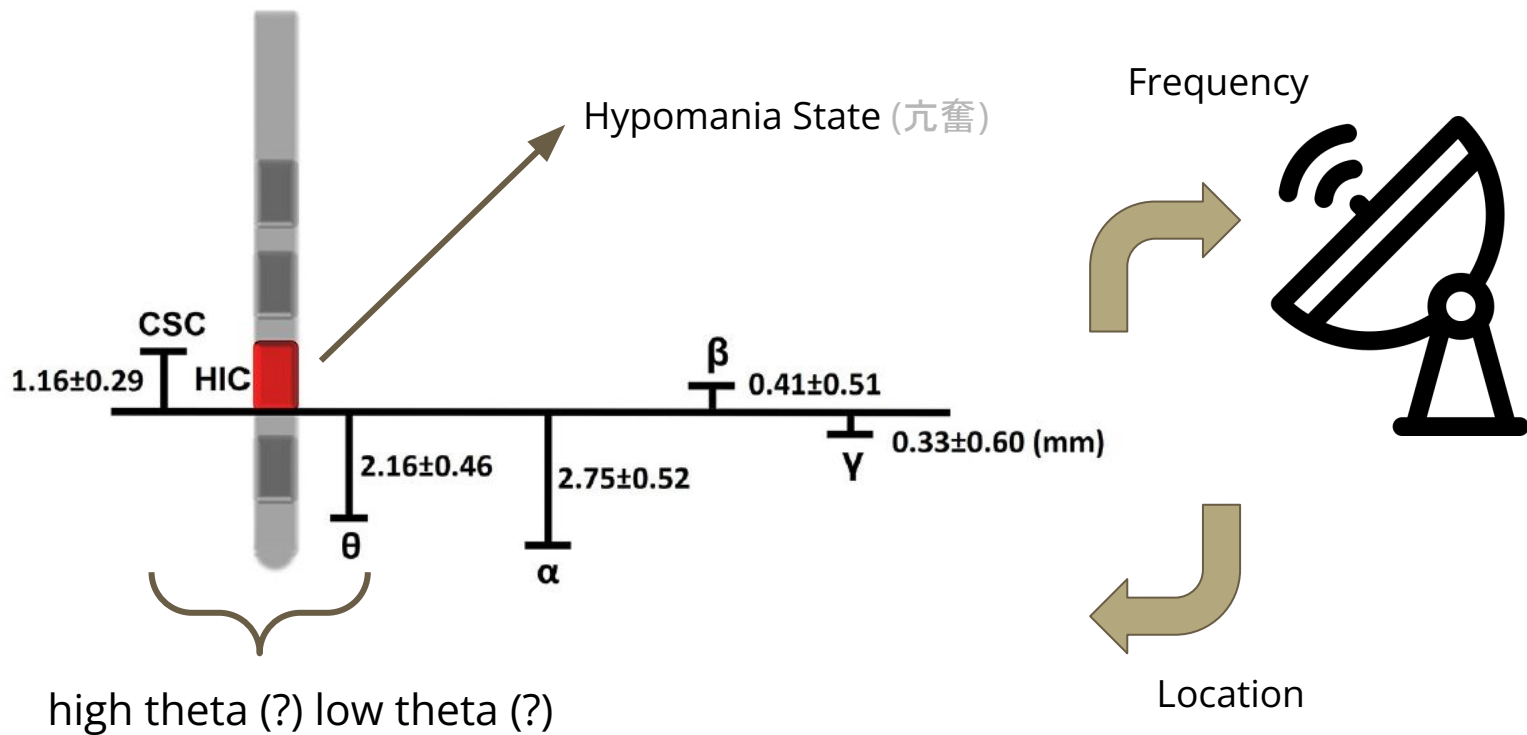# ConceST
– A New Method to Increase Resolution –
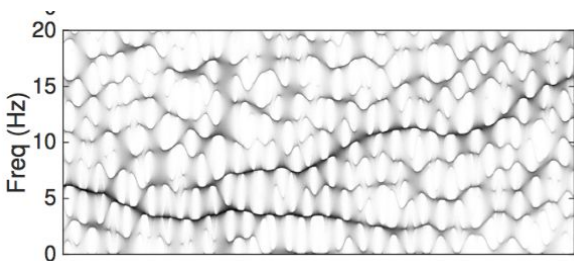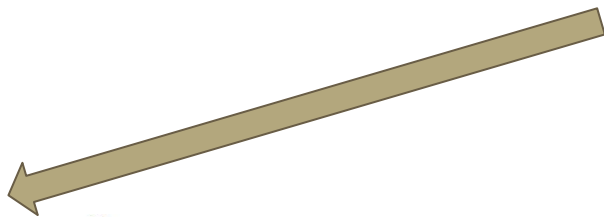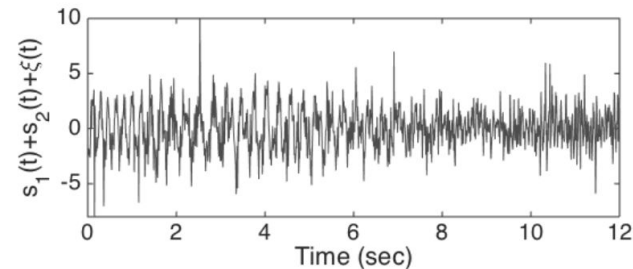
Yi-Ju Yen & Sing-Yuan Yeh

Problem

Hypomania State (亢奮)

CSC
1.16±0.29   HIC

β 0.41±0.51

2.16±0.46   2.75±0.52   0.33±0.60 (mm)

θ   α   γ
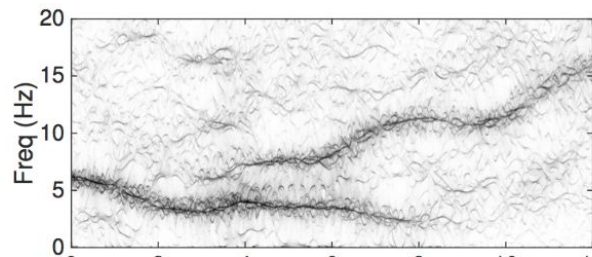
high theta (?) low theta (?)

Frequency

Location

captured from Chen et al. (2021). link.

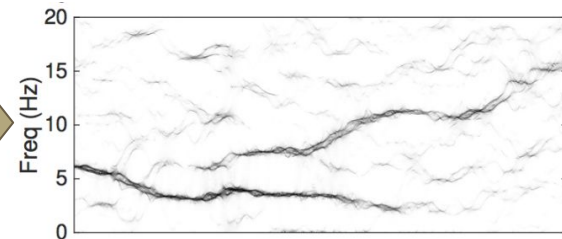# Recall methodology of ConceFT
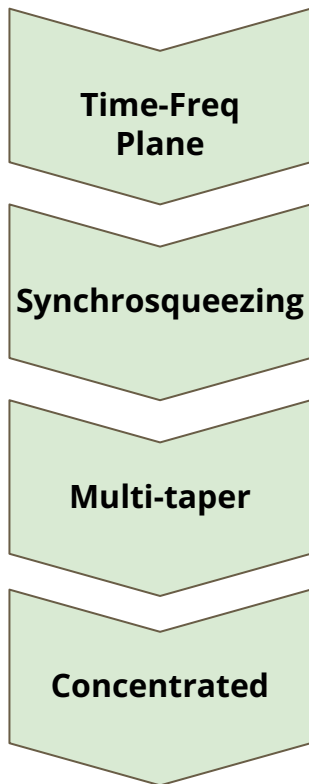

Synchrosqueezing Fourier Transform (FSST)

Multi-taper Synchrosqueezing Fourier Transform (MTFSST)

Concentrated MTFSST (ConceFT)
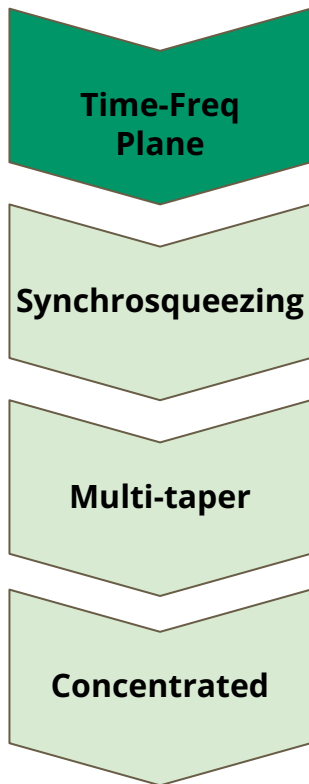
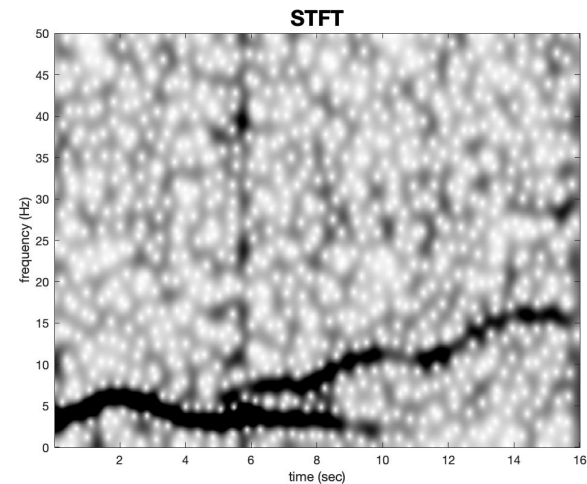Captured from Daubechies, Wang & Wu, (2015).

New method: ConceST

Time-Freq Plane	Short time fourier transform (STFT)	S-transform (ST)
Synchrosqueezing	Synchrosqueezing Fourier transform (FSST)	Synchrosqueezing S-transform (SSST) Huang et al. (2015), link.
Multi-taper	Multi-taper FSST (MTFSST)	Multi-taper SSST (MTSSST) Huang et al. (2022), link.
Concentrated	Concentrated FT (ConceFT) Daubechies et al. (2016). link.	Concentrated ST (ConceST)

Time-Freq Plane

Time-Freq Plane
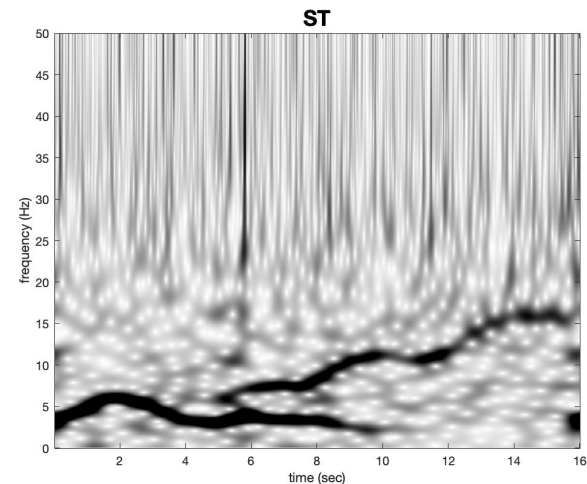
Synchrosqueezing

Multi-taper

Concentrated

- Time frequency analysis

Short time Fourier Transform (STFT)

STFT

S-Transform (ST)

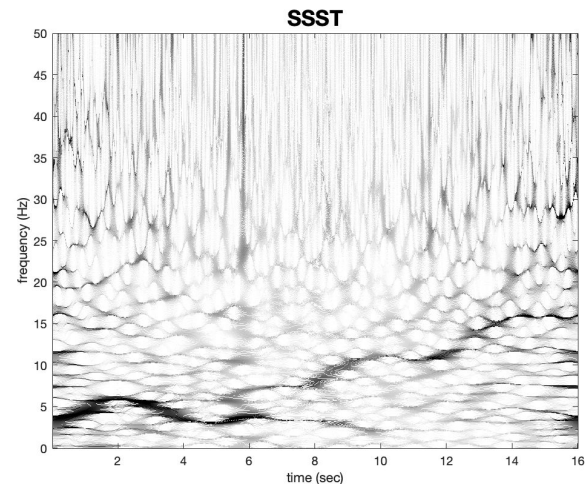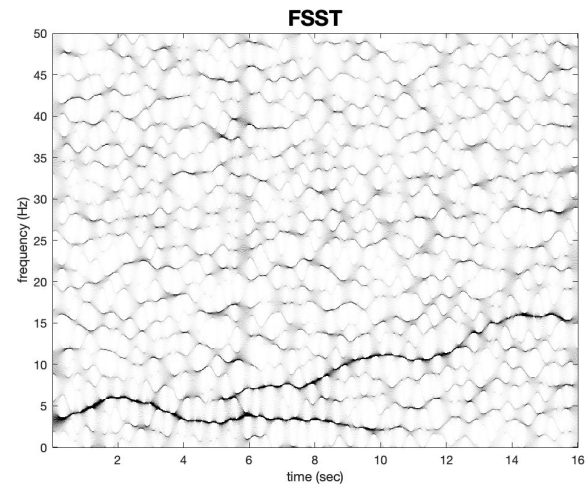ST

Synchrosqueezing

Time-Freq Plane

Synchrosqueezing

Multi-taper

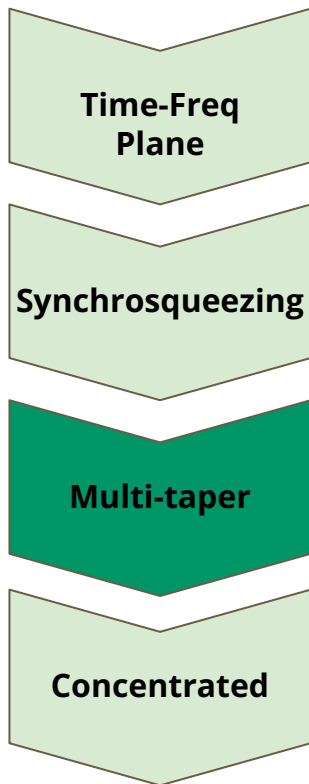Concentrated

Synchrosqueezing Fourier Transform (FSST)

- calculate reassignment index to squeeze bright strip

Synchrosqueezing S-Transform (SSST)

FSST

SSST

Multi-taper

Multi-taper FSST

Multi-taper SSST

```
Time-Freq
Plane
```

```
Synchrosqueezing
```

```
Multi-taper
```

```
Concentrated
```

- Use different window to reduce bias
- Averge different TF plane by different window

Concentrated

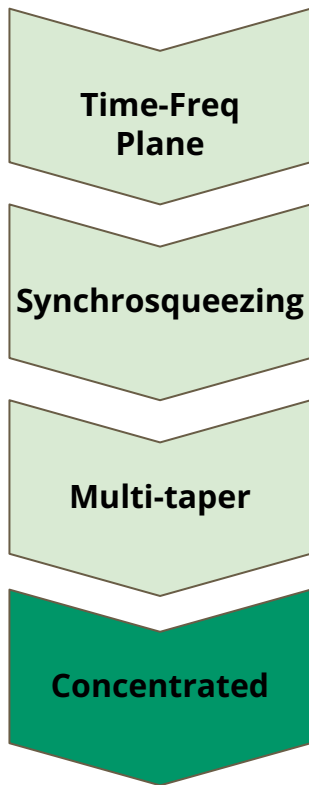**Concentrated STFT
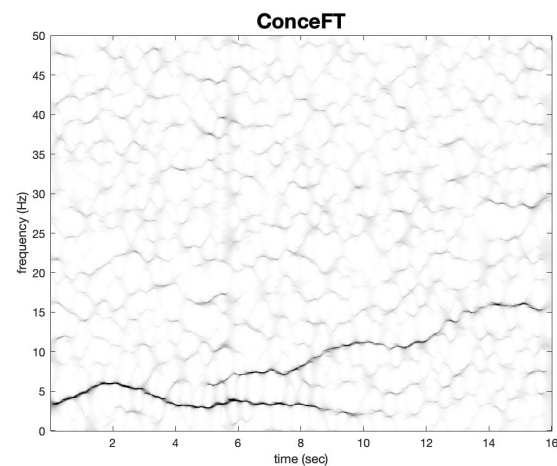(ConceFT)**

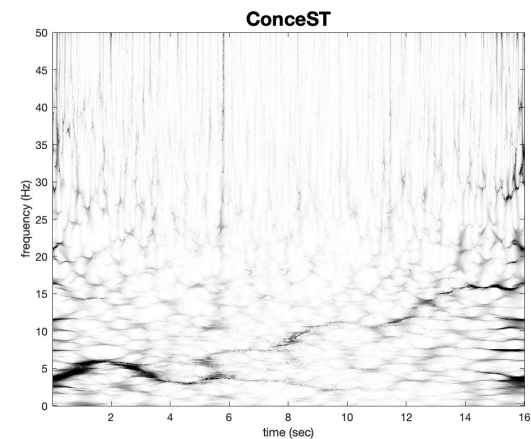**Time-Freq Plane**

Synchrosqueezing
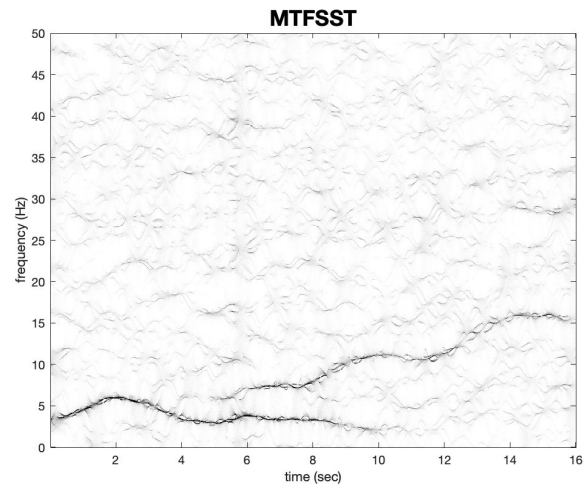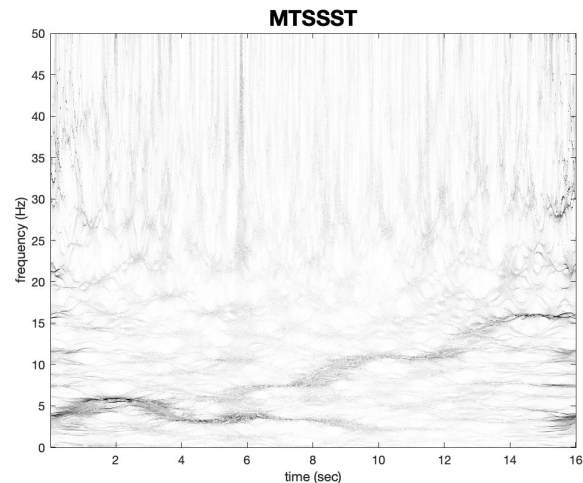
Multi-taper

Concentrated

- Random weight assign different taper
- Average all weighted multi-taper TF plane

**Concentrated ST
(ConceST)**

Discussion

1. We can adjust the hyper-parameter to contral which band we want to focus on. e.g. theta band. Refer to Huang et al. (2022), link.

2. Without any trick, the ST is better than STFT in lower frequency band.

3. The first order squeeze method is applied. We can try higher order. Refer to Pham & Meignen, (2017), link.
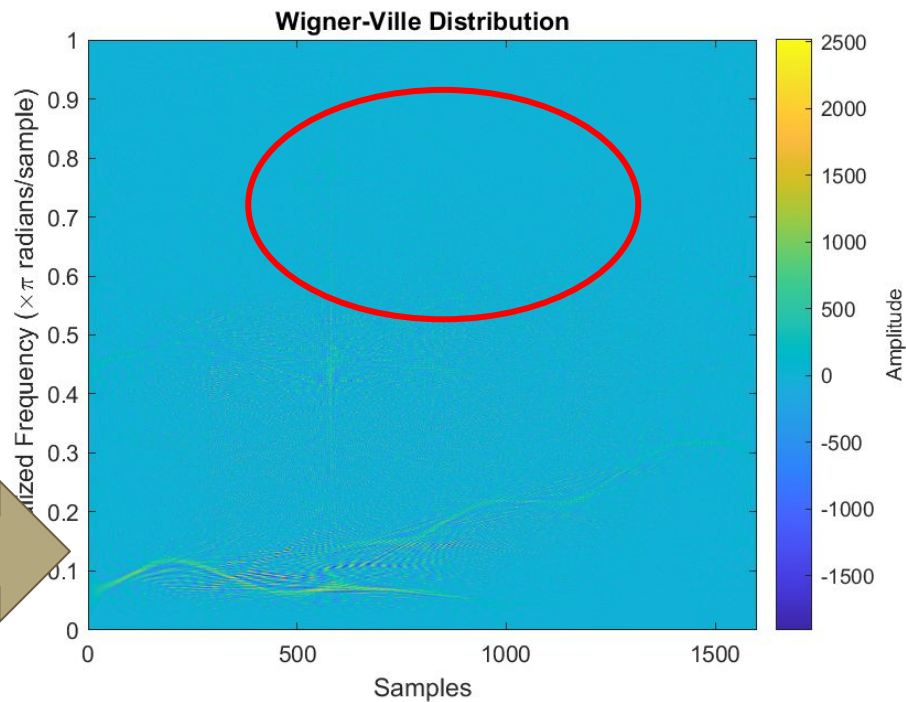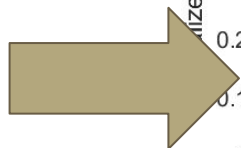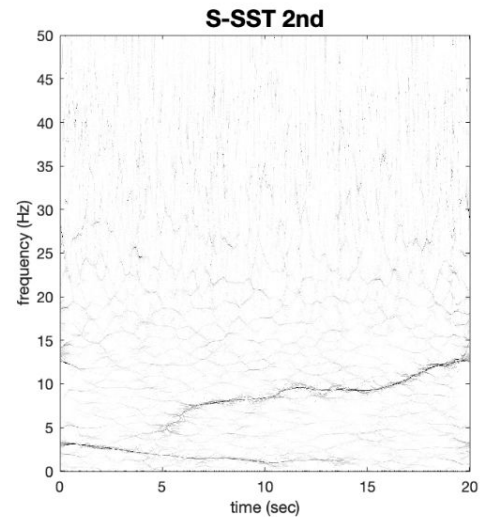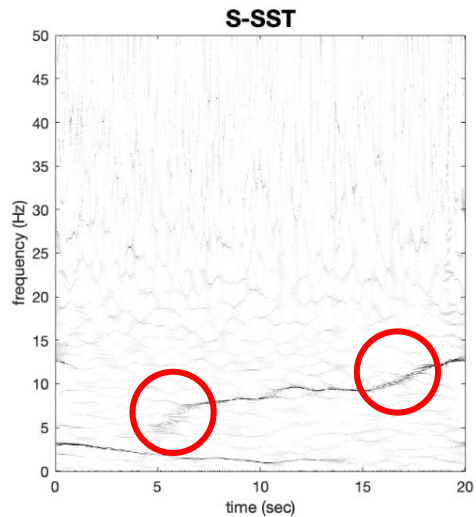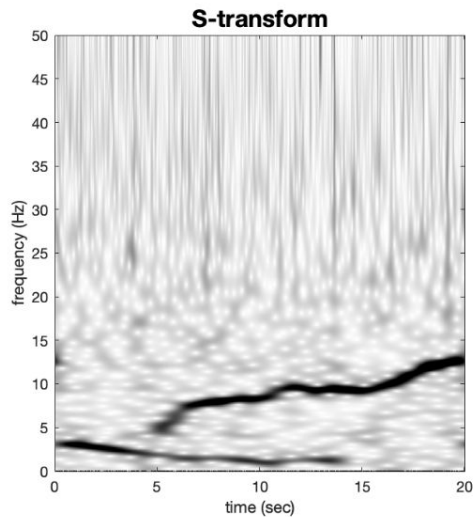
Taper correction
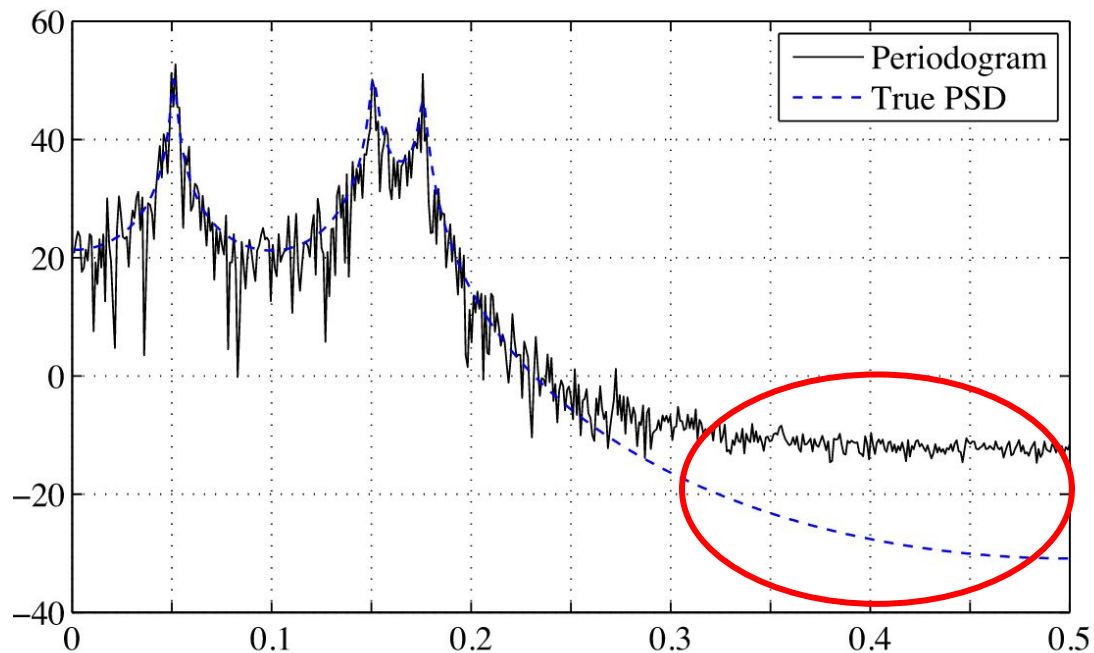
higher frequency

In our case

focus low frequency

second order SSST

Real data?

Wavelet Synchrosqueezed Transform