



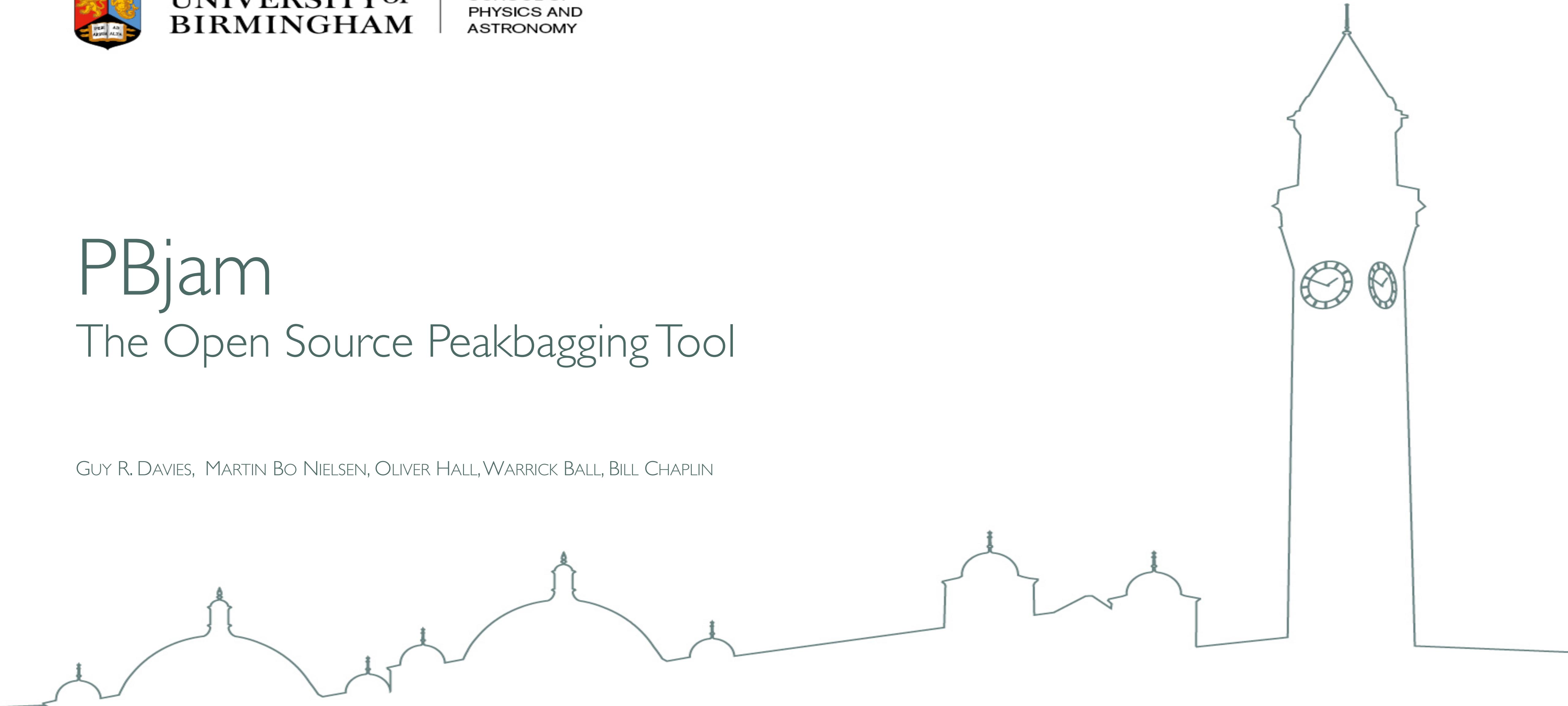
UNIVERSITY OF
BIRMINGHAM

SCHOOL OF
PHYSICS AND
ASTRONOMY

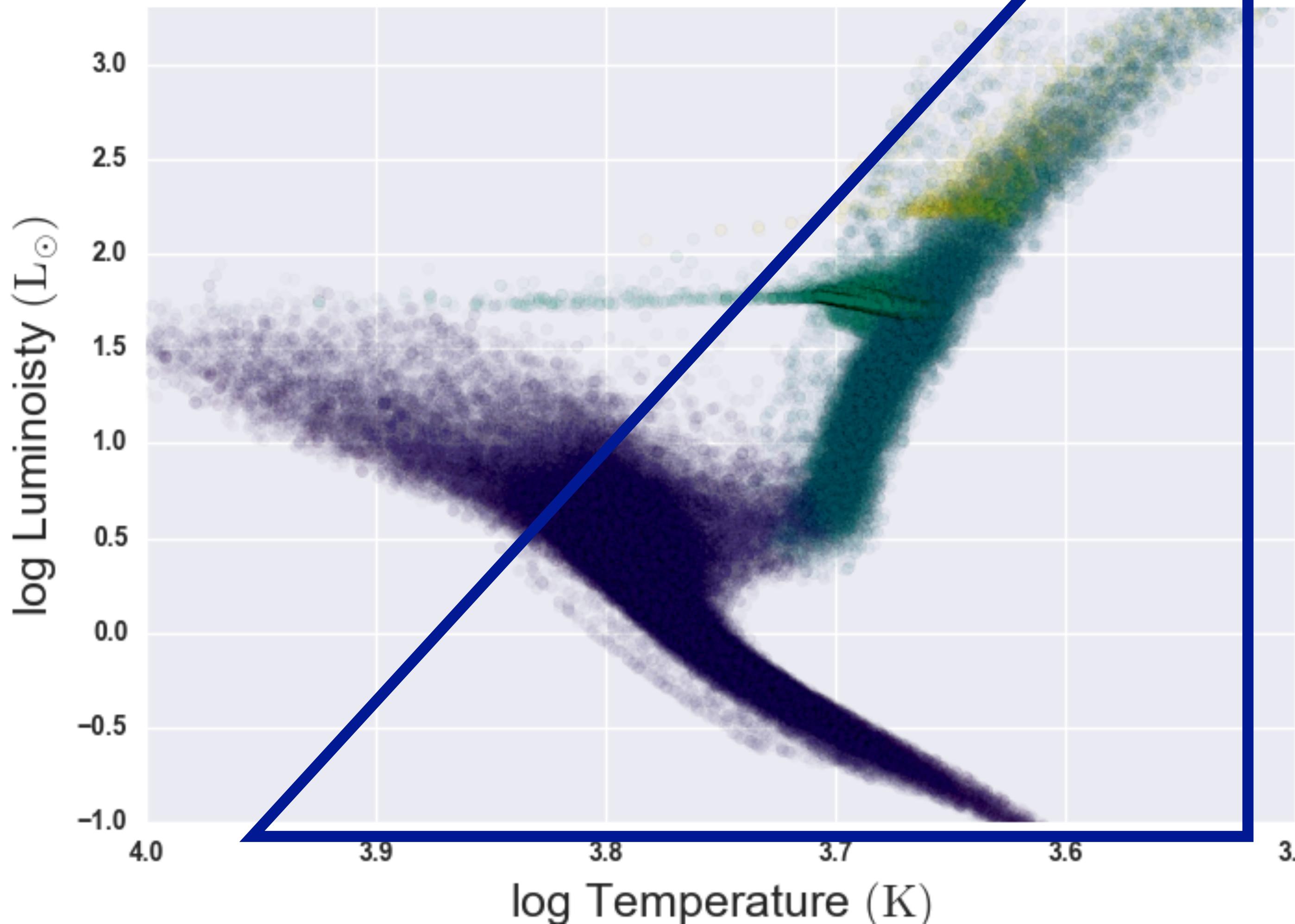
PBjam

The Open Source Peakbagging Tool

GUY R. DAVIES, MARTIN BO NIELSEN, OLIVER HALL, WARRICK BALL, BILL CHAPLIN



What types of stars are we talking about?



Solar-like pulsators

- Red Giants
- Subgiants
- Main sequence
- High SNR
- Low SNR
- Good frequency resolution
- Bad frequency resolution
- CoRoT/Kepler/K2/TESS/
PLATO



PBjam vision:

- Will peak bag solar-like pulsations
- No domain-specific expertise required
- Easy to use
- Provide a platform to adopt improvements over time

PBjam

Navigation

[Installation](#)

[User Guide](#)

[API](#)

[License](#)

[Help & Contact](#)

Quick search

Go

PBjam

Peakbagging made easy

[GitHub](#) [PBjam](#) [docs](#) [passing](#) [license](#) [MIT](#) [issues](#) [73 closed](#)

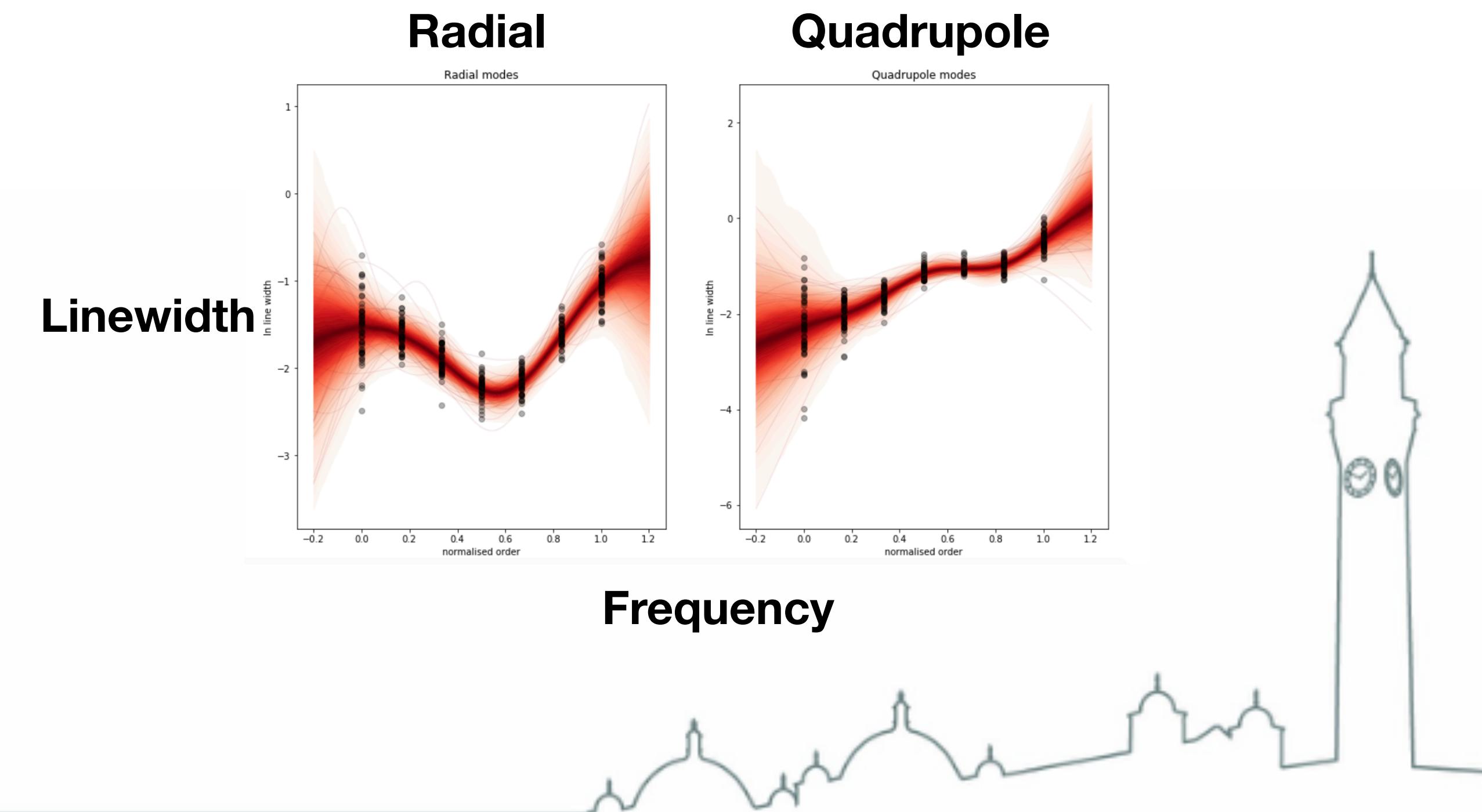
PBjam is toolbox for modeling the oscillation spectra of solar-like oscillators. This involves two main parts: identifying a set of modes of interest, and accurately modeling those modes to measure their frequencies.

Currently, the mode identification is based on fitting the asymptotic relation to the $l=2,0$ pairs, relying on the cumulative sum of prior knowledge gained from NASA's Kepler mission to inform the fitting process.

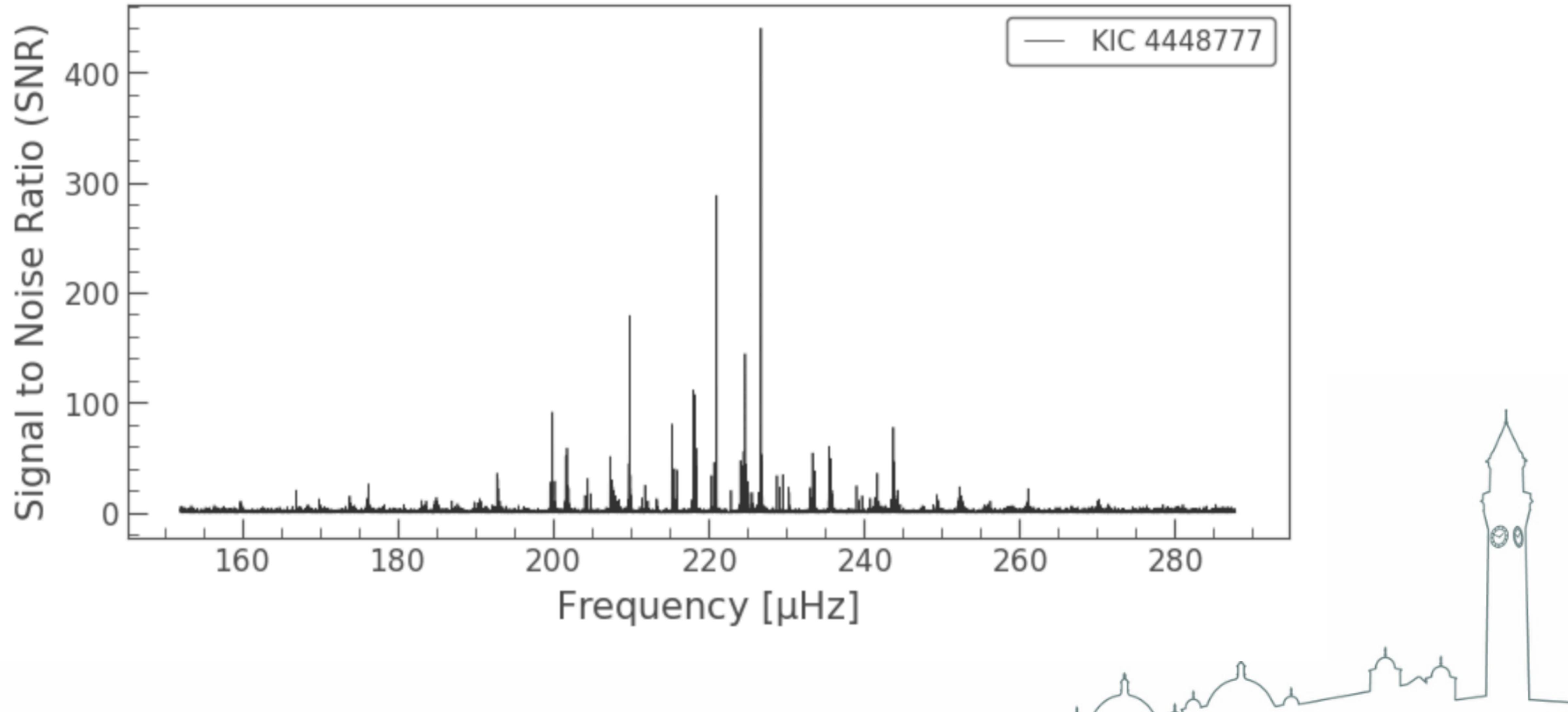


PBjam notes:

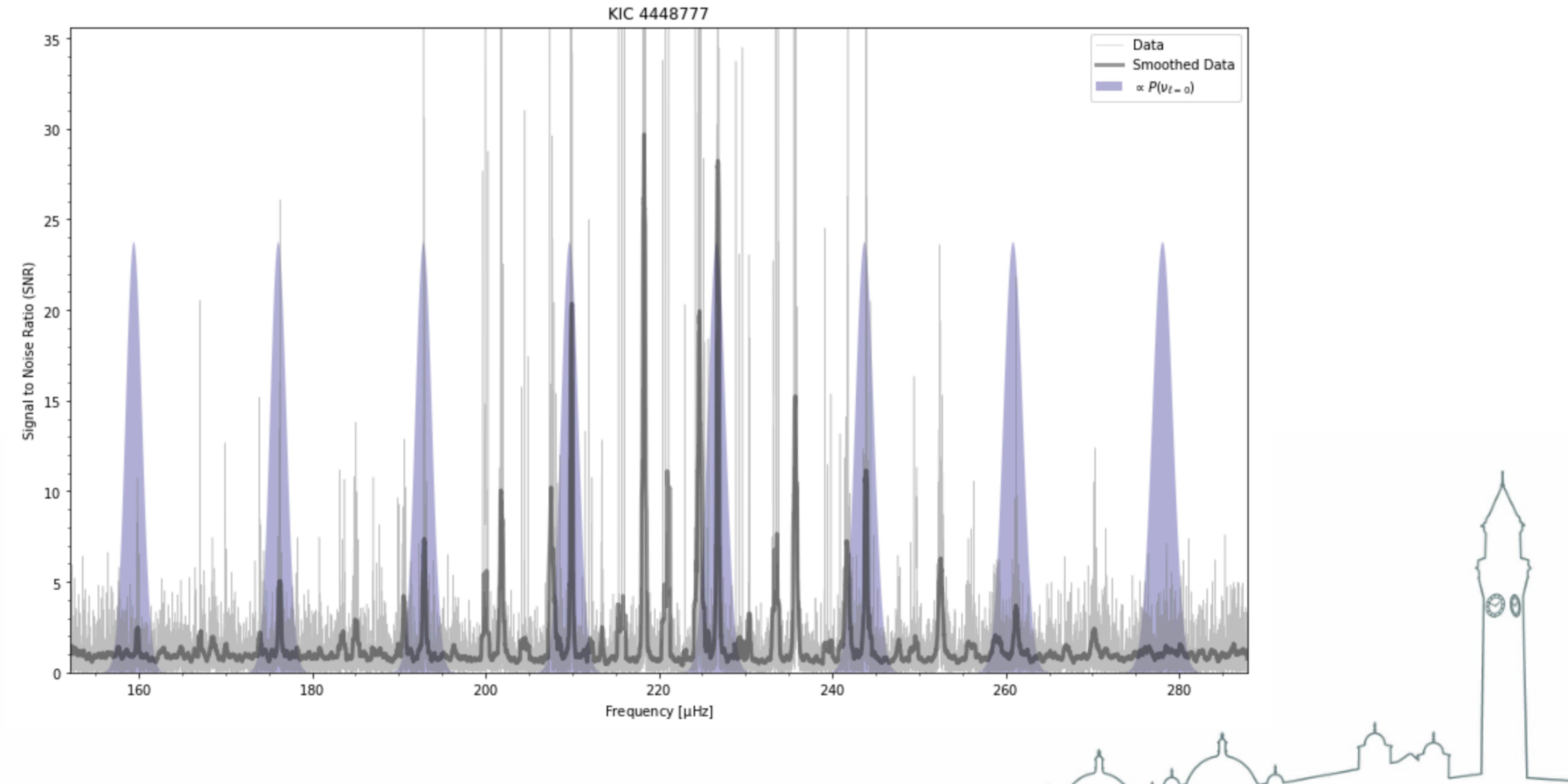
- So far radial and quadrupole modes
 - Prior setup for giants - expanding all the time
 - Dipole modes coming soon
 - GP priors implemented
 - Get involved!



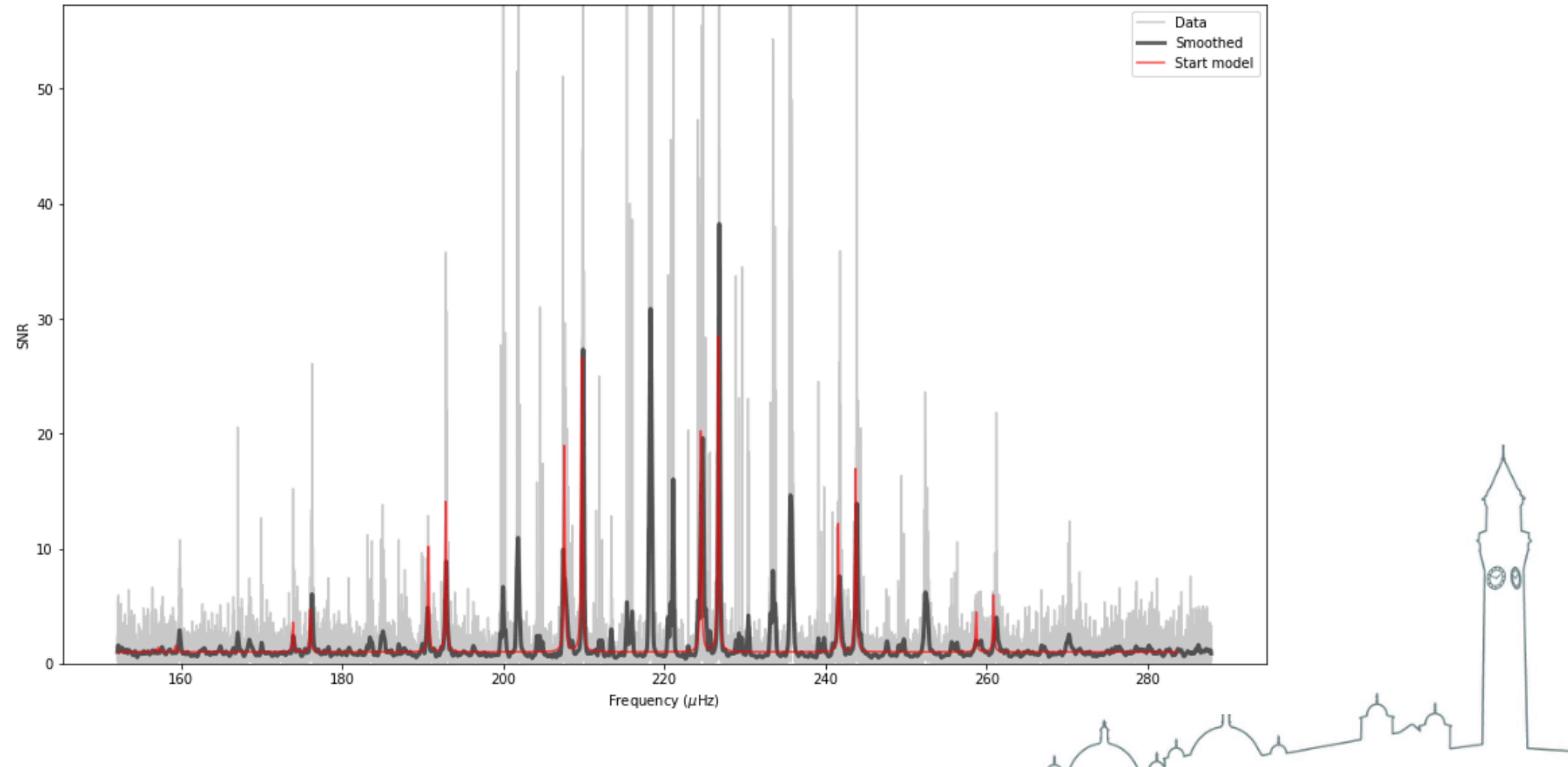
PBjam very brief method:



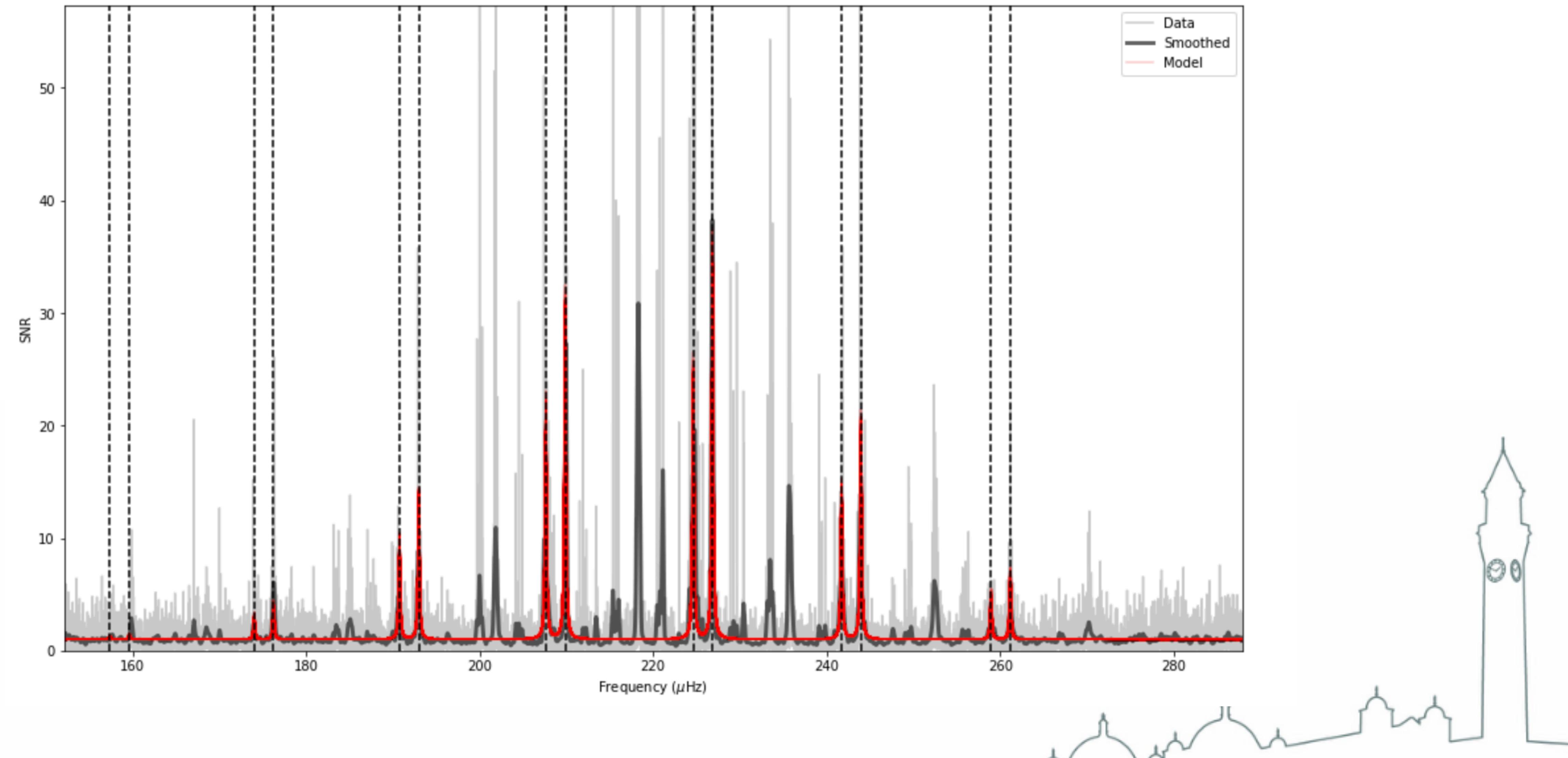
PBjam very brief method:



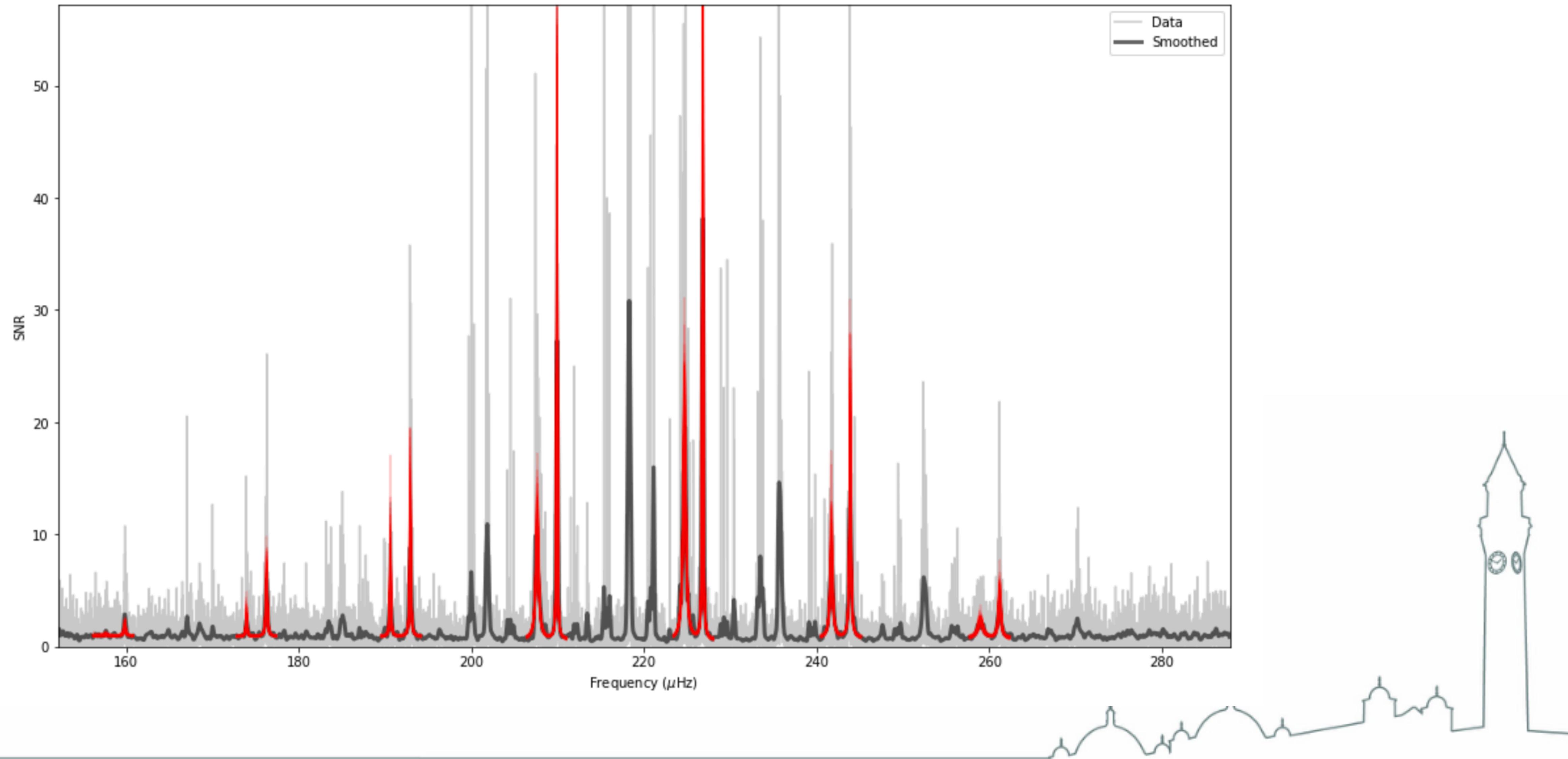
PBjam very brief method:



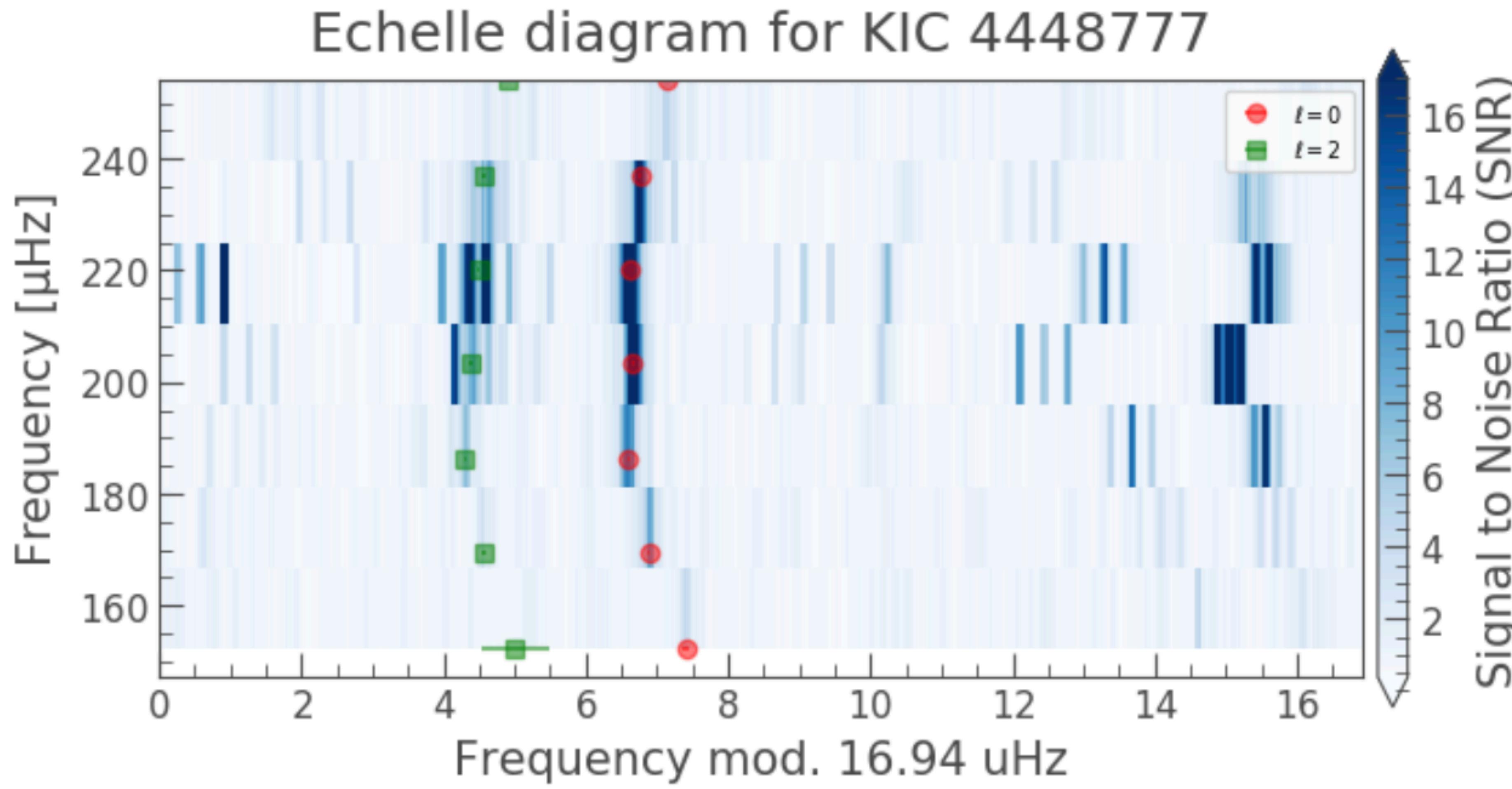
PBjam very brief method:



PBjam very brief method:



PBjam very brief method:



PBjam low level API:

```
In [8]: ep = pb.epsilon()
result = ep(dnu=dnu, numax=numax, teff=teff, bp_rp=bp_rp)
```

```
10%|■          | 2000/20000 [00:31<04:45, 63.10it/s]
```

Converged after 2000 iterations.

```
In [11]: asy = pb.asy_peakbag.asymptotic_fit(pg.frequency.value, pg.power.value,
                                             ep.samples,
                                             teff, bp_rp,
                                             norders=7)
```

```
In [13]: asy_result = asy.run(teff=teff, bp_rp=bp_rp)
```

```
8%|■          | 1500/20000 [01:44<21:27, 14.37it/s]
```

Converged after 1500 iterations.

```
In [16]: pbag = pb.peakbag(pg.frequency.value, pg.power.value, asy_result)
pbag.sample(model_type='simple', cores=4, tune=1500)
```

Auto-assigning NUTS sampler...

Initializing NUTS using adapt_diag...

Multiprocess sampling (4 chains in 4 jobs)

NUTS: [back, height2, height0, width2, width0, 12, 10]

```
Sampling 4 chains: 100%|██████████| 8000/8000 [01:28<00:00, 90.24draws/s]
```

PBjam star:

```
In [8]: st = pb.star(ID, pg, numax, dnu, teff, bp_rp, make_plots=True)
```

```
In [9]: st(norders = 7)
```

```
10%|■           | 2000/20000 [00:32<04:28, 67.06it/s]
```

Converged after 2000 iterations.

```
8%|■           | 1500/20000 [01:50<21:59, 14.02it/s]
```

Converged after 1500 iterations.

Auto-assigning NUTS sampler...

Initializing NUTS using adapt_diag...

Sequential sampling (2 chains in 1 job)

NUTS: [back, height2, height0, width2, width0, 12, 10]

```
100%|[██████] 2000/2000 [00:55<00:00, 36.20it/s]
```

```
100%|[██████] 2000/2000 [00:48<00:00, 41.41it/s]
```

KIC 4448777



PBjam session:

```
sess = pb.session(dictlike='mytgts.csv')
```

Here you can either just give PBjam the path to the csv file, or load the csv manually as a [pandas dataframe](#) or Python dictionary.

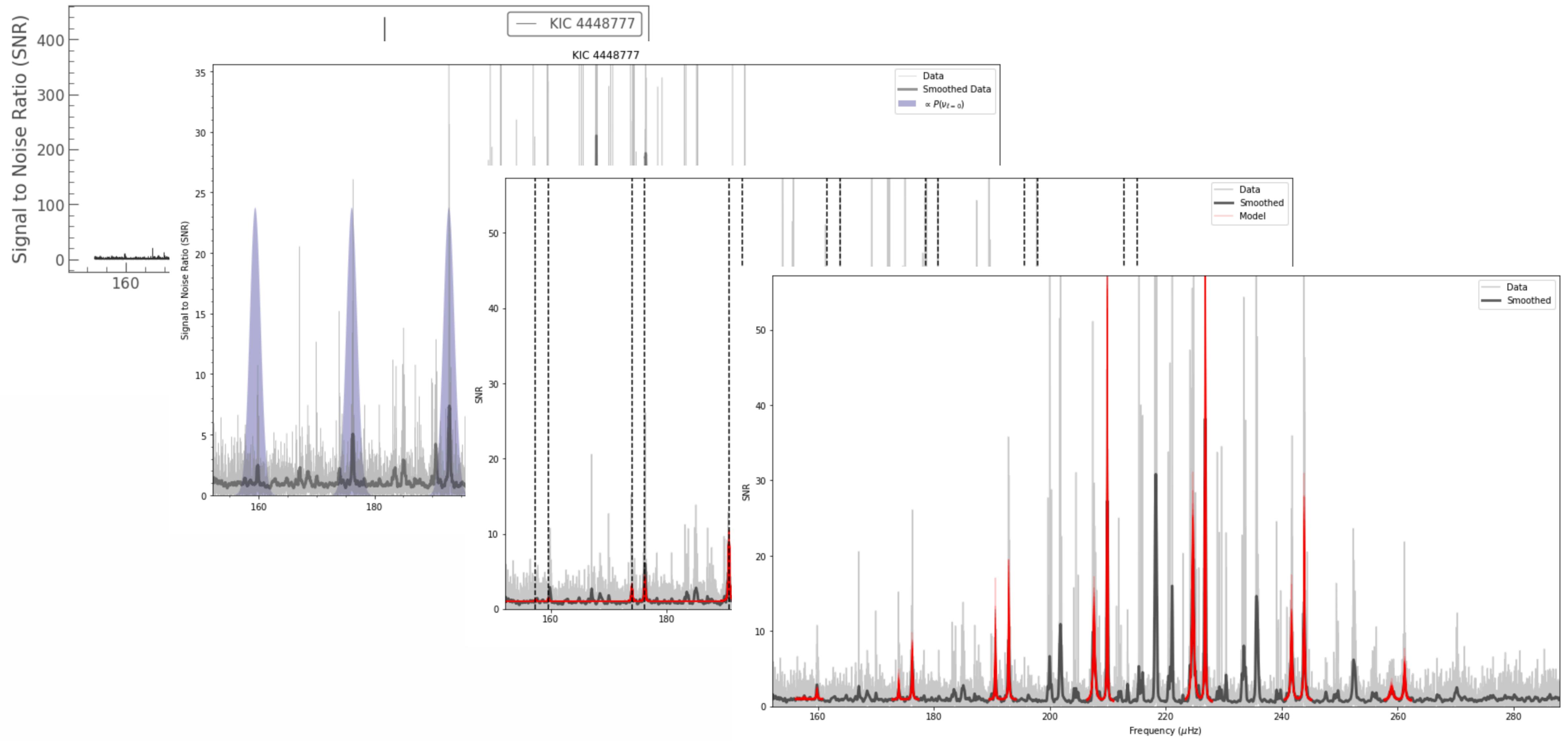
Note: You must have a specific set of keywords in the dictionary/dataframe/csv file, shown below

```
import pandas as pd
df = pd.read_csv('mytgts.csv')
df.head()
```

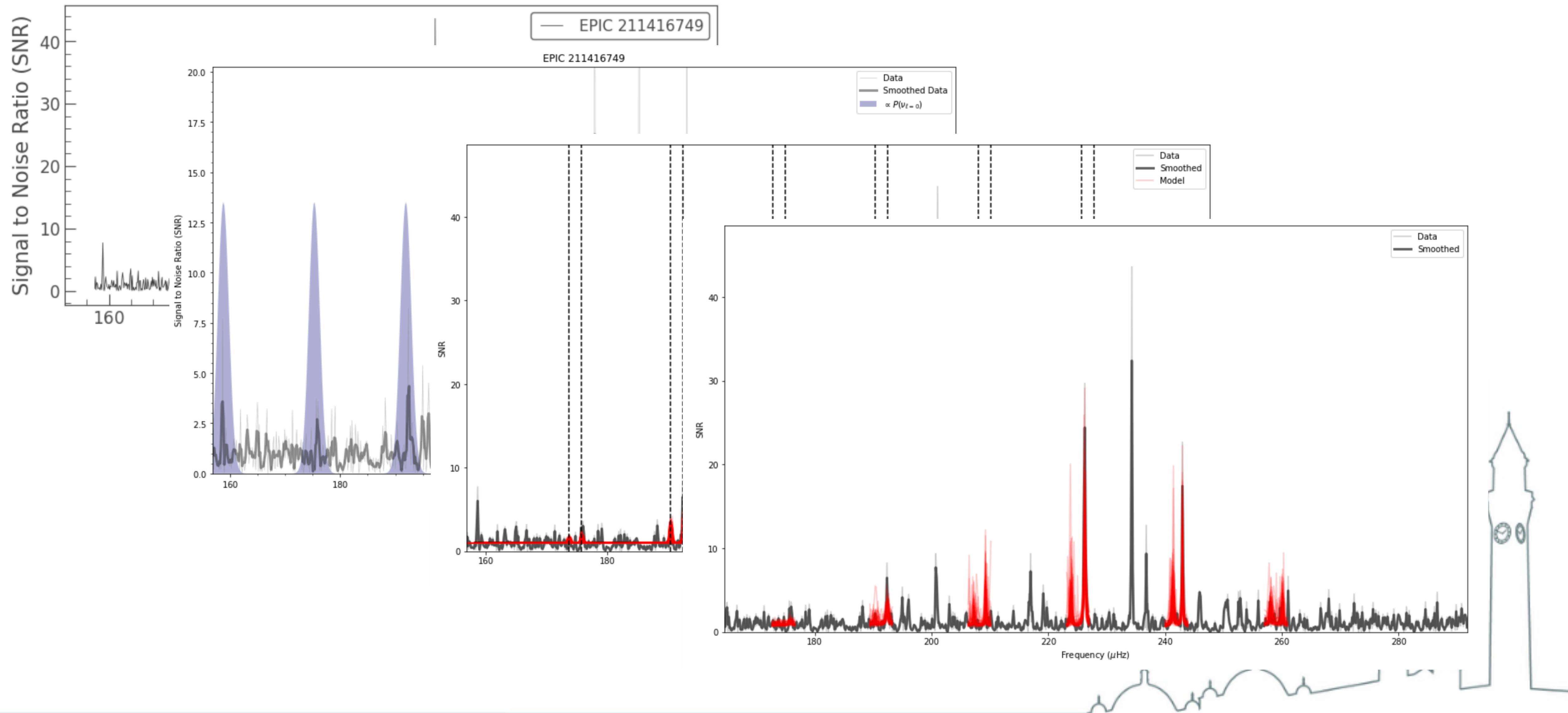
	ID	dnu	dnu_err	numax	numax_err	teff	teff_err	bp_rp	bp_rp_err
0	1433593	6.241	0.013	69.14	0.59	4956	100	1.327025	0.05
1	1433730	4.085	0.019	40.37	0.54	4767	100	1.424954	0.05
2	2018392	3.795	0.013	33.92	0.55	4908	100	1.417112	0.05
3	2140446	5.673	0.012	57.60	0.56	4665	100	1.446697	0.05
4	2307683	4.309	0.012	39.95	0.51	4799	100	1.369279	0.05



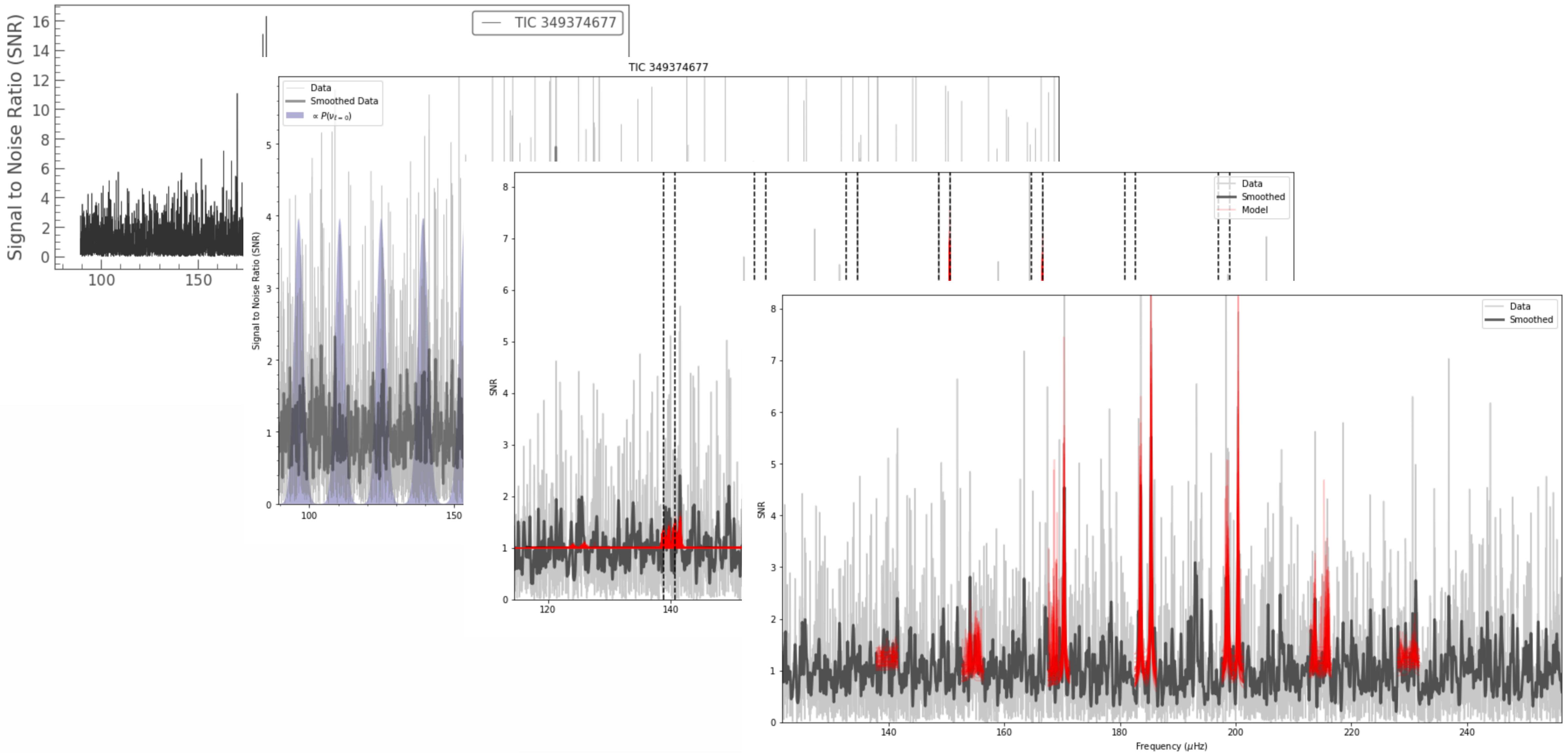
PBjam Kepler:



PBjam K2:



PBjam TESS:



PBjam conclusions:

- Will peak bag solar-like pulsations
- No domain-specific expertise required
- Easy to use
- Provide a platform to adopt improvements over time
- Get involved!

