GAIA NSL and orbit determination of short period binaries and planets

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Importance of the period search

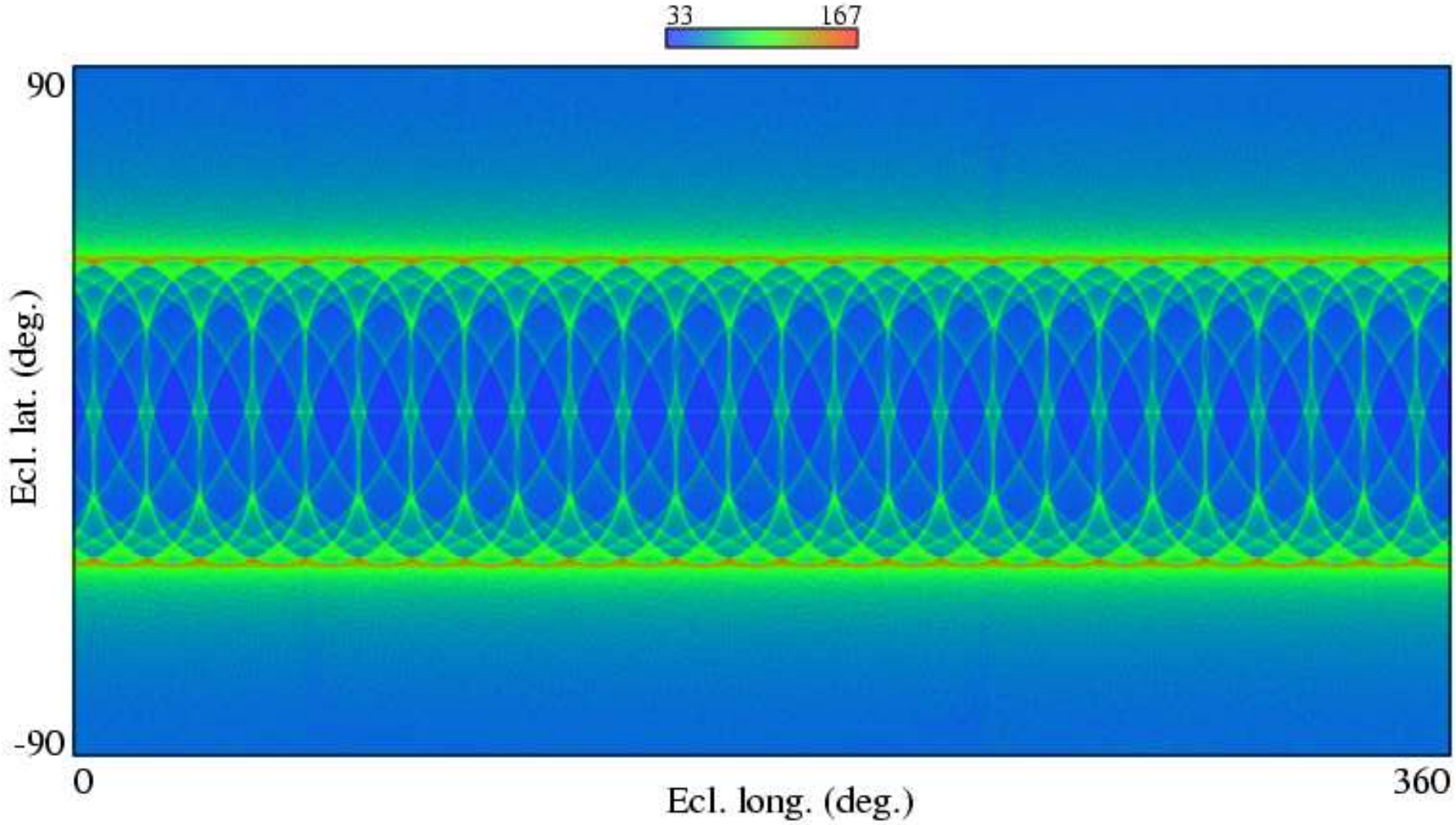
Several workgroups need a good period finder:

- DMS/PS: essential first step in astrometric orbit fitting
- DMS:essential first step in spectroscopic orbit fitting
- Variability: light curve analysis

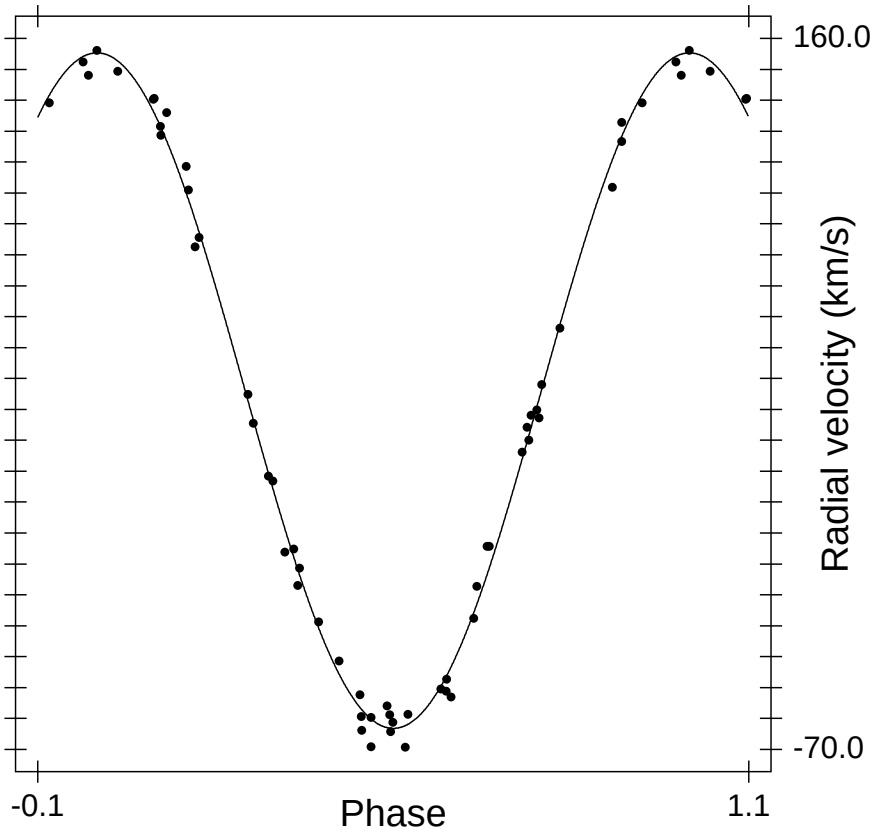
Tools:

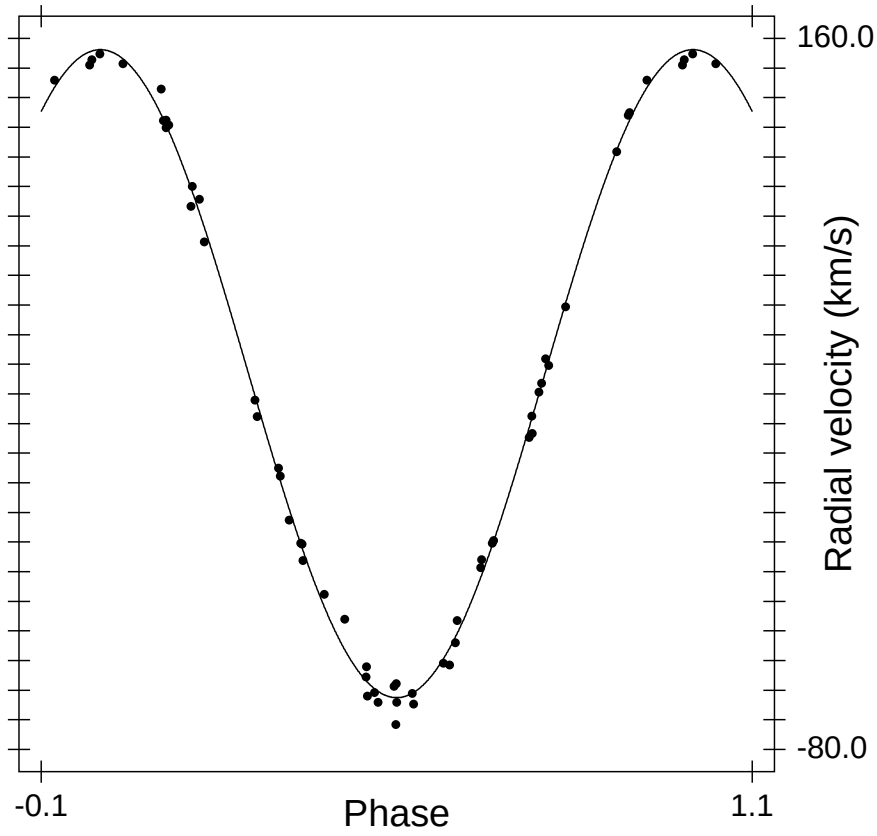
- Scargle-like periodogram: fast but assumes a unique sine curve in the signal
- PDM-like: no assumption about the model but data must be sorted at each iteration
- Deeming (Fourier-like): no assumption about the signal, each periods could be detected in combination with the spectral window.

Number of observations



Which one is right?

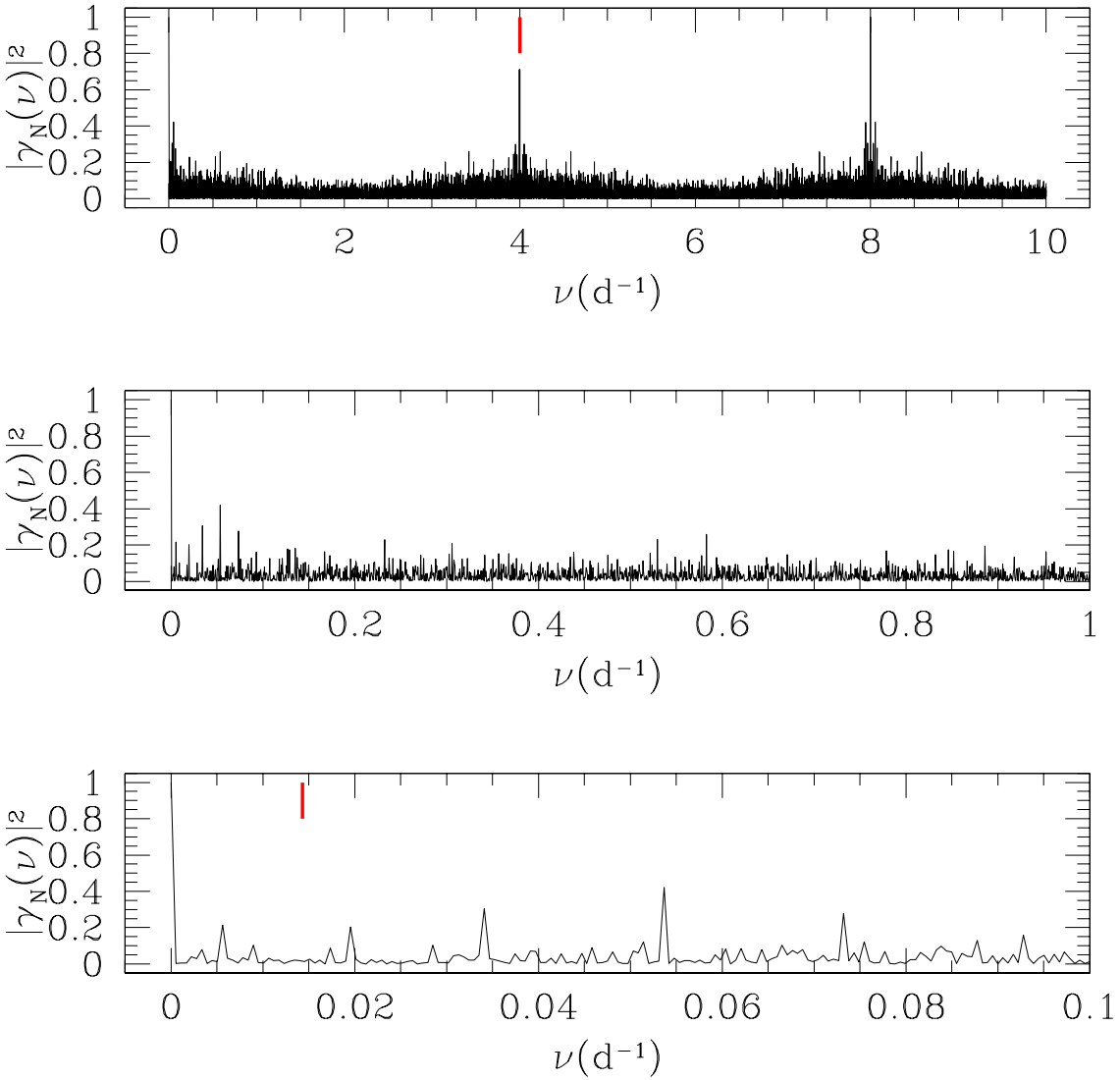




$\hat{P} = 0.073$d $\qquad\qquad$ $\hat{P} = 0.18$d

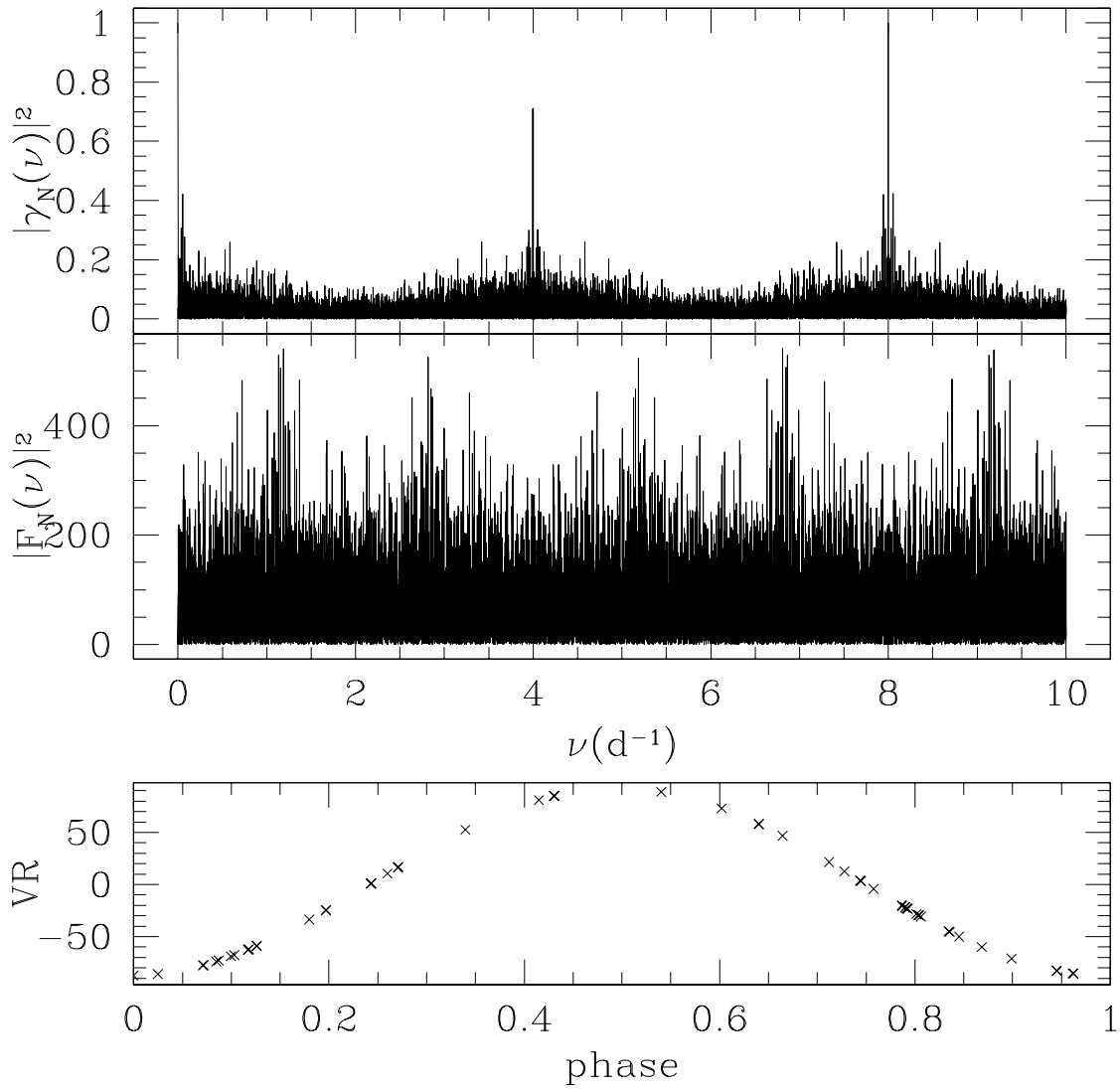
Both data sets generated with $P = 0.1758$d!

Example of a NSL spectral window



- Rotation period (6h) present in the time series
- No trace of the precession period (70d).

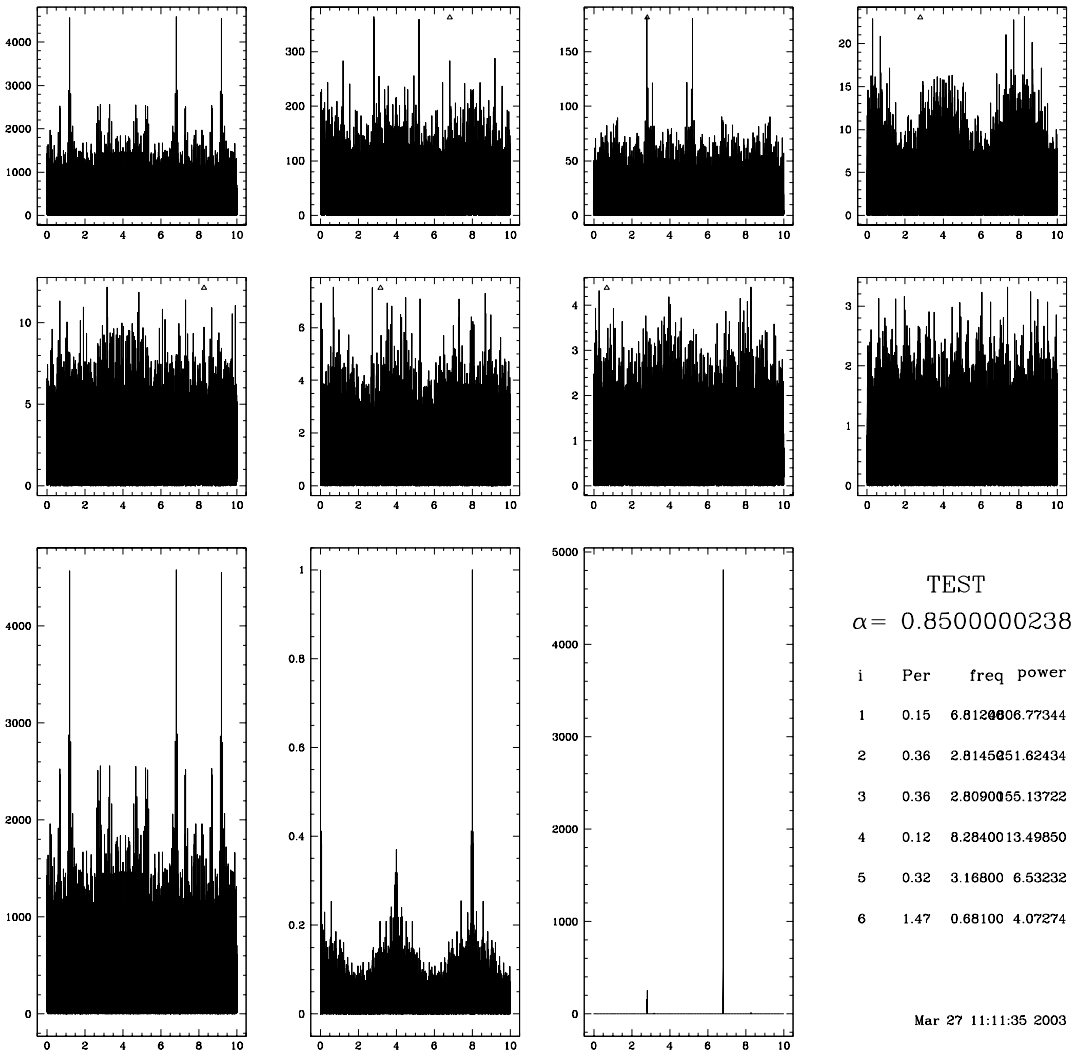
Deeming: power spectrum



High S/N data but, still, tons of peaks in the power spectrum!

Cleaning the power spectrum

(P. Bartholdi, priv. comm.)



TEST

$\alpha =$ 0.8500000238

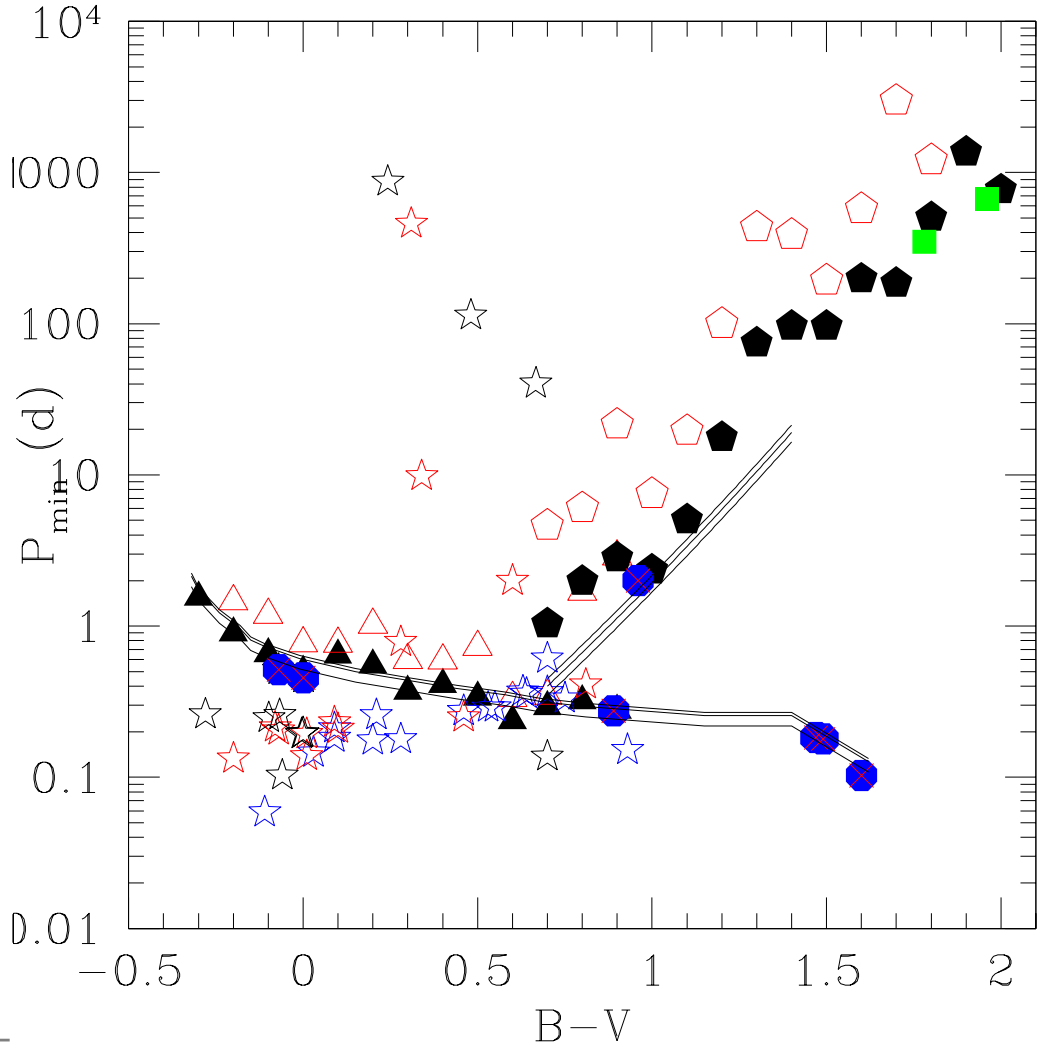
i	Per	freq	power
1	0.15	6.81206	606.77344
2	0.36	2.81450	251.62434
3	0.36	2.80900	155.13722
4	0.12	8.28400	13.49850
5	0.32	3.16800	6.53232
6	1.47	0.68100	4.07274

Mar 27 11:11:35 2003

Idea: recovering the fundamental frequencies of the signal by removing the frequencies present in the spectral window

HR diag. and orbital period

Based on S_{B^9}



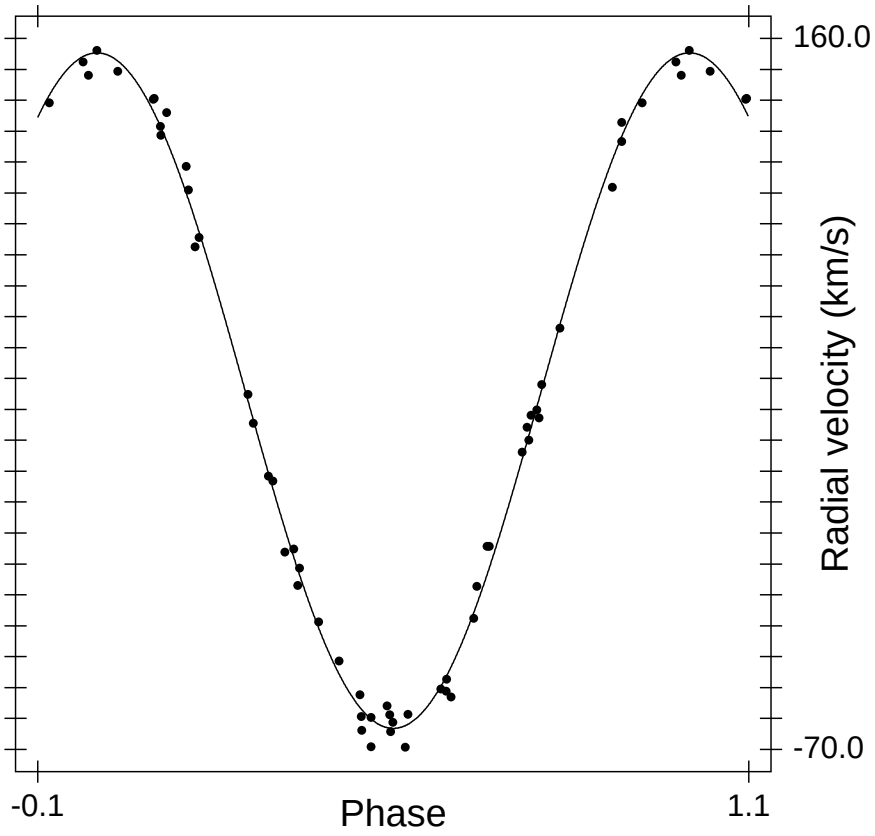
Roche lobe filling prevents short period binaries.

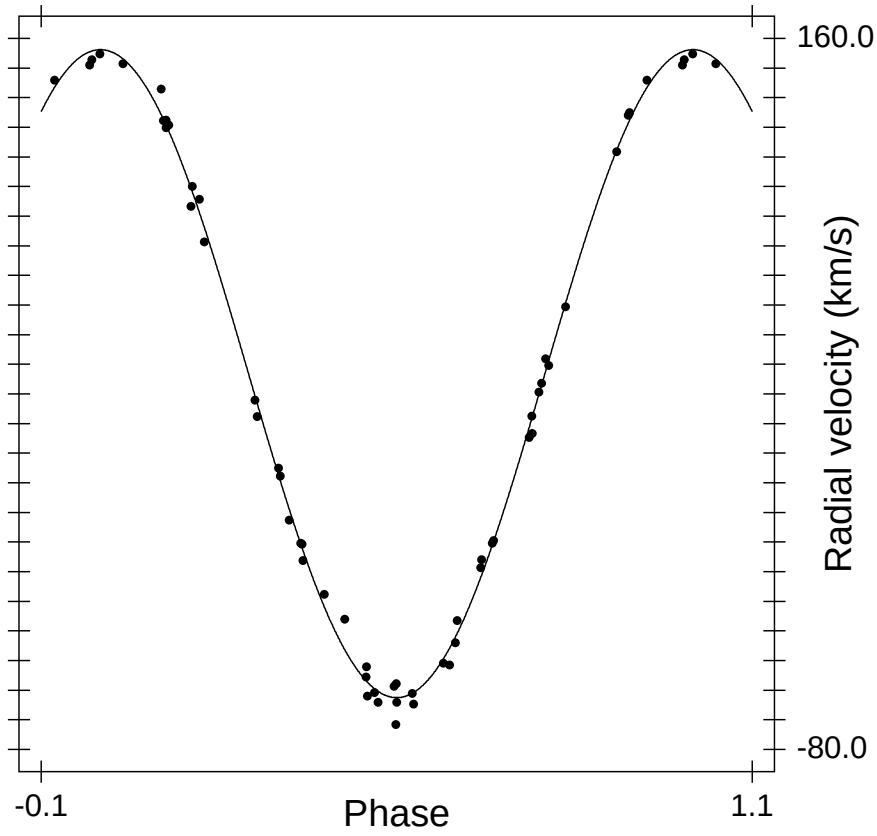
Position in the HR diag can limit the range of periods that need to be investigated.

Conclusion

- Even though 2 consecutive observations can be much closer than 6h, the Nyquist frequency is close to $4\mathrm{d}^{-1}$.
- One should not look for any period shorter than 6h.
- One ignores some semi-detached systems (e.g. WD+MS). According to S_{B^9}, 3.5% of the systems have orbital period shorter than 6h.
- One could break the regularity of the NSL by adding a ground-based data (e.g. from RAVE).

Which one is right?





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