

PS 5: Time Series

1. The Lomb-Scargle Periodogram

Construct a monochromatic sinusoidal function of a vector of random times in *R*.

Construct a L-S periodogram from your time series. You can use the “lomb” package if you trust it, or you can implement your solution from

Scargle, J. D. in *ApJ* 263 (1982) pp. 835-853.

Answer the following questions,

a) Were you able to identify the periodicity of your time series?

b) Do you see any signs of aliasing or spectral leakage? Did you expect to see them?

Why and why not?

c) Explain how aliasing and spectral leakage arise, and how you might mitigate them.

d) Produce your *R* code and plots of your time series and your periodogram.

Label any interesting features that you see.

Download the radial velocity time series of 51 Pegasi from

<http://sl50.web.rice.edu/astr_600/51peg_1.vels>.

Construct a L-S periodogram from the RV data and answer the following question,

e) Were you able to identify the accepted (find information on this object) orbital period from the transformed data? Attach a plot of your periodogram.

2. The Light Curve of KIC-8554498

Download the light curve of KIC-8554498 from

<http://sl50.web.rice.edu/astr_600/plot.tbl>.

Construct a L-S periodogram. Answer the following questions,

a) Were you able to identify the periodicity of transit events?

b) Were you able to identify the length of the transit?

c) Attach a plot of your periodogram. Label any interesting features.

Implement the minimum string length algorithm by

Dworetsky, M. M. in *MNRAS* 203 (1983) pp. 917-924.

Answer the following questions,

d) Were you able to identify the periodicity of transit events?

e) Were you able to identify the length of the transit?

f) Attach your *R* implementation and a plot of the string length vs. trial period.

Implement the box-fitting least squares algorithm by

Kovács, G.; Zucker, S.; Mazeh, T. in *A&A* 391 (2002) pp. 369-377.

Answer the following questions,

g) Were you able to identify the periodicity of transit events?

h) Were you able to identify the length of the transit?

i) Attach your *R* implementation and a plot of the folded light curve.