The (generalized) Lomb-Scargle periodogram

The Lomb-Scargle periodogram is commonly used for period search and frequency analysis of time series. It is equivalent to fitting sine waves of the form $y = a\cos\omega t + b\sin\omega t$, for a given frequency ω. This method provides an analytic solution and is therefore both convenient to use and efficient. The equation for the periodogram was given by Barning [1963], and Lomb [1976] and Scargle [1982] further investigated its statistical behaviour, especially the statistical significance of the detection of a signal.

Because the detection of periodicities in time series data is such a common problem, many generalisations of the Lomb-Scargle periodogram have been proposed. These take into account individual measurement errors, the inclusion of a constant offset, or other types of periodic signals [Ferraz-Mello, 1981, Cumming et al., 1999, Zechmeister and Kürster, 2009, Mortier et al., 2015]. Computer implementations of these algorithms are also common and mature in many programming languages.

Exercise 1: Use the `astropy` implementation of the Lomb-Scargle periodogram to search for periodic variations in the radial velocities of EPIC 211089792. Take into account each individual RV uncertainty. Plot the periodogram, and calculate the period of maximum power. Fold the RV observations at the best period.

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