Subject: Re: The spectra of fluctuations in variable
Posted by Craig Markwardt on Thu, 15 Mar 2007 15:20:24 GMT
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"duxiyu@gmail.com" <duxiyu@gmail.com> writes:

> I have a time series B(T).
> The time resolution dt of the data is 4s and the amount N is 1000.
> The unit of B and T is 'nT' and 's'.
> I want to study its fluctuaions in frequence space using the power
> spectral density (PSD).
>
> BB=FFT(B)
> freq=FINDGEN(N)/(N*dt)
>
> Then I am not clear how to caculate the PSD.
> Maybe, PSD=(ABS(BB))^2, but there is a problem in the unit.
> The unit of BB is 'nT' that is the same as B, so the unit of PSD which
> is obtained by the above method is 'nT^2'.
> But in physical view the unit of PSD should be 'nT^2/Hz'.

If you want "per Hertz" then you need to divide the powers by the
spacing between adjacent frequencies.

Also, you will have to worry some about the normalization of the FFT.
Experiment with FFT(B,+1) and FFT(B,-1) until you get what you want.

> The other question is how to caculate the phase difference between two
> B1 and B2.
> I caculate it by the following method, but I am not sure whether it is
> right.
>
> BB1=FFT(B1)
> BB2=FFT(B2)
> phase1=ATAN(BB1,/phase)
> phase2=ATAN(BB2,/phase)
> difference=phase1-phase2
>
> Moreover, the angles seems not smoothed by regular method because of
> theirs periodicity.
> Is there other method to smooth the angle data?

I would normally recommend multiplying the fourier coefficients
to form the "cross spectrum,"
 CR12 = BB1 * CONJ(BB2)
You can rebin or smooth these complex numbers as you wish, and then
compute ATAN() on the result.  Finding the uncertainties of those

values is a much more complicated process.

Good luck,
Craig

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