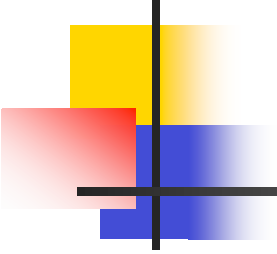Roger New

Sheffield Hallam University

Development of data analysis algorithms – thoughts from the solar case
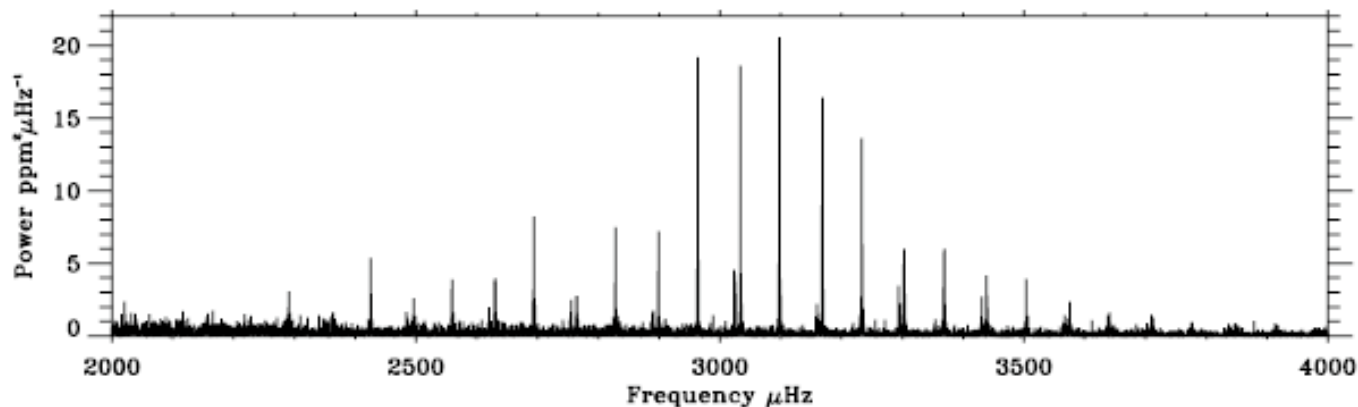
1st KASC Workshop Oct 30th 2007

Structure of the talk

- Reporting large/small spacing results
- Fitting mode parameters – "local" versus "global"
- Activity cycle effects
- Extracting rotation information
- Conclusions

Reporting large spacing values

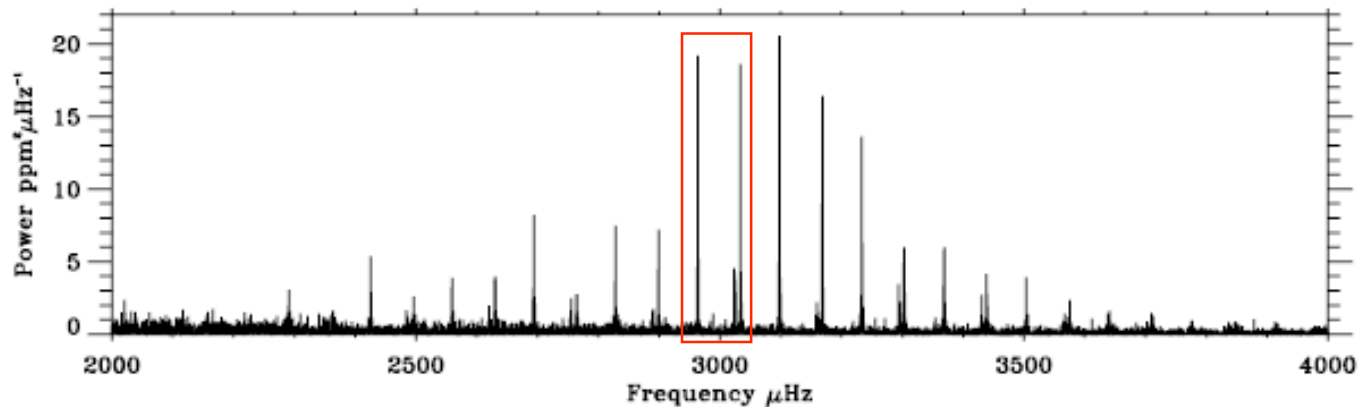(Fröhlich et al 1997, 200 days of data from SOHO, SPM)

With poorer S/N –

will necessarily work on a limited range of the spectrum

need to define that range and any weighting used to provide average values of the spacings (Chaplin et al poster)

"Global" versus "Local" fitting 1

It's common in the solar case to fit each group of ℓ = 0,2 and ℓ = 1,3 independently of its neighbours.
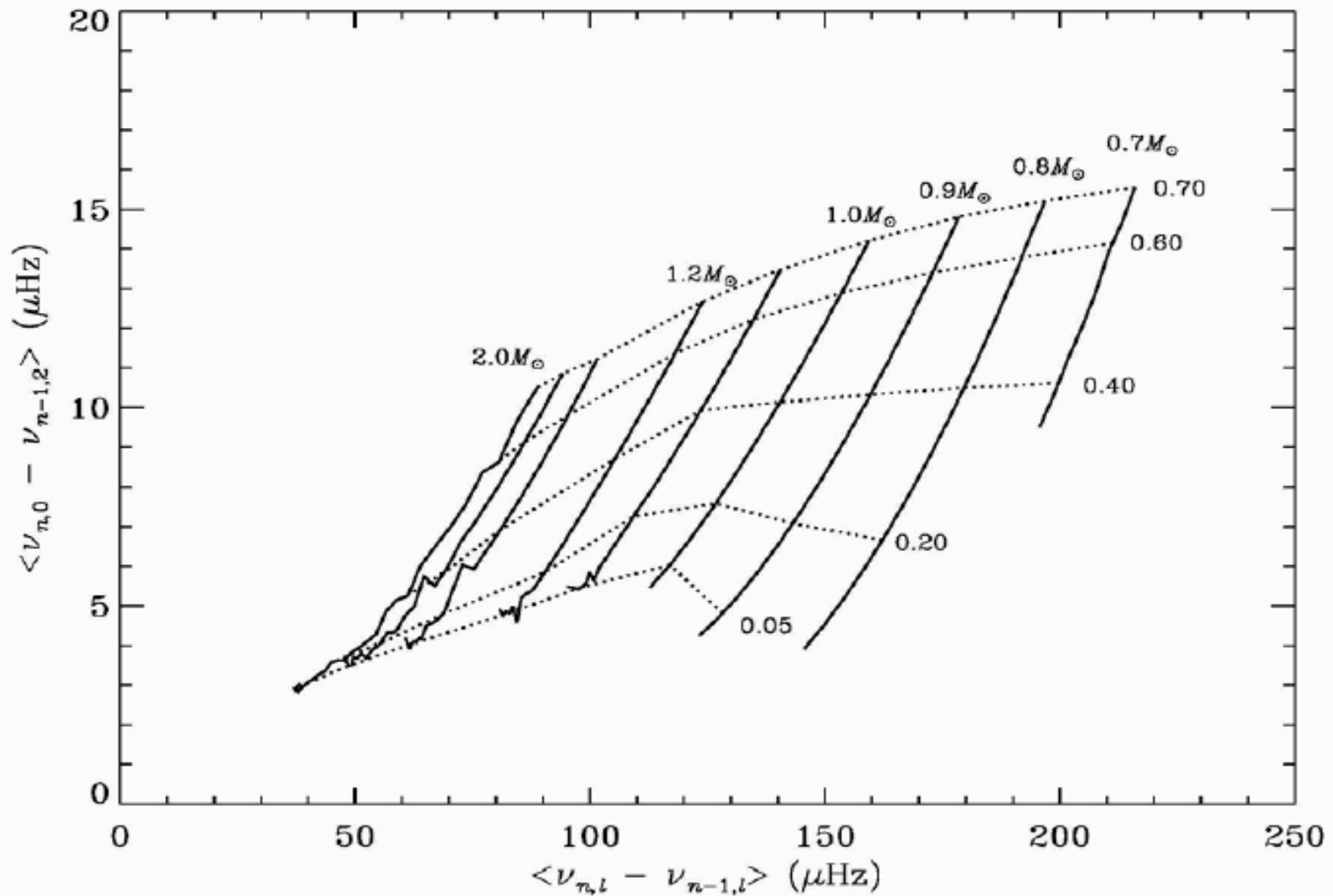
Extracted parameters may include:-

mode frequencies, heights, widths, splittings and asymmetries and a local background level

"Global" versus "Local" fitting 2

In this common approach the extracted parameters are biased by contamination from the "wings" of neighbouring modes
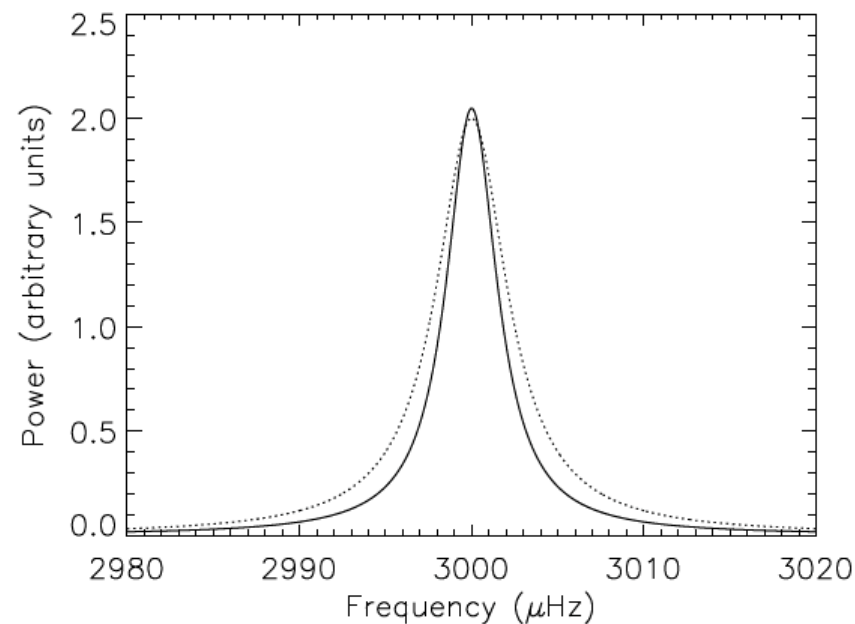
Fletcher et al, in press

Higher mass stars will have more tightly grouped modes – the effects will be more significant.

Can also try a "global" fit to the whole spectrum (Appourchaux...)

Activity cycles

Over the solar cycle:-

- mode frequencies vary by as much as 1 μHz

- mode widths may vary by about 20%

- mode heights may vary by about 50%

The effects of observing for <u>part</u> of a cycle need careful consideration (Chaplin et al, submitted, MNRAS)

1) May be able to extract varying parameters
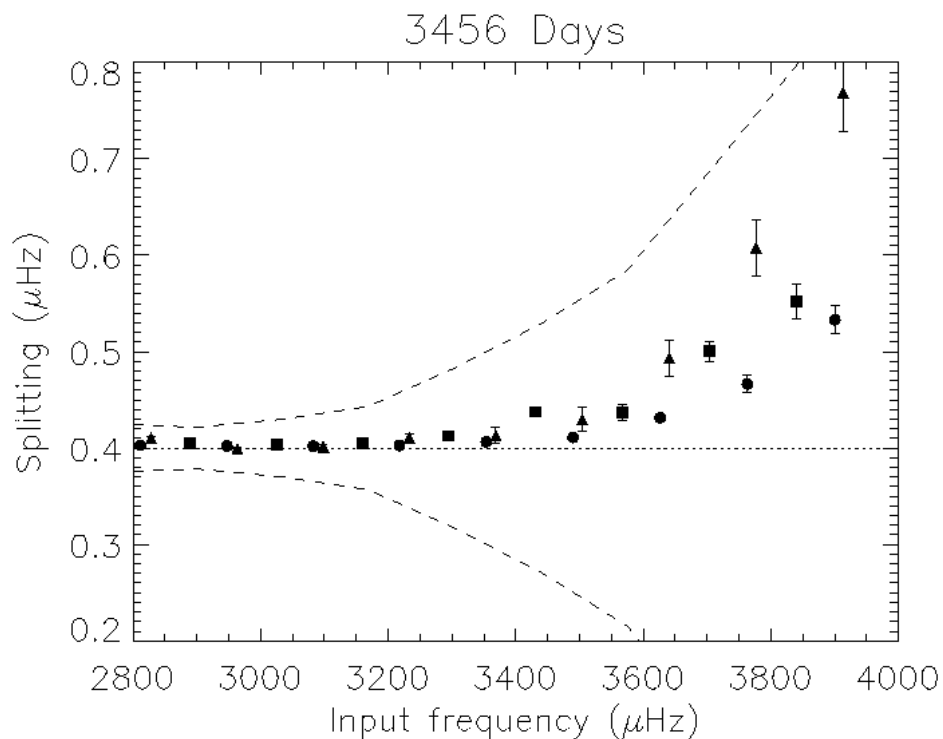2) May need to be aware of "blurred" parameters

Extracting rotation 1

In the solar case, the ratio of rotational splitting to linewidth varies considerably:-
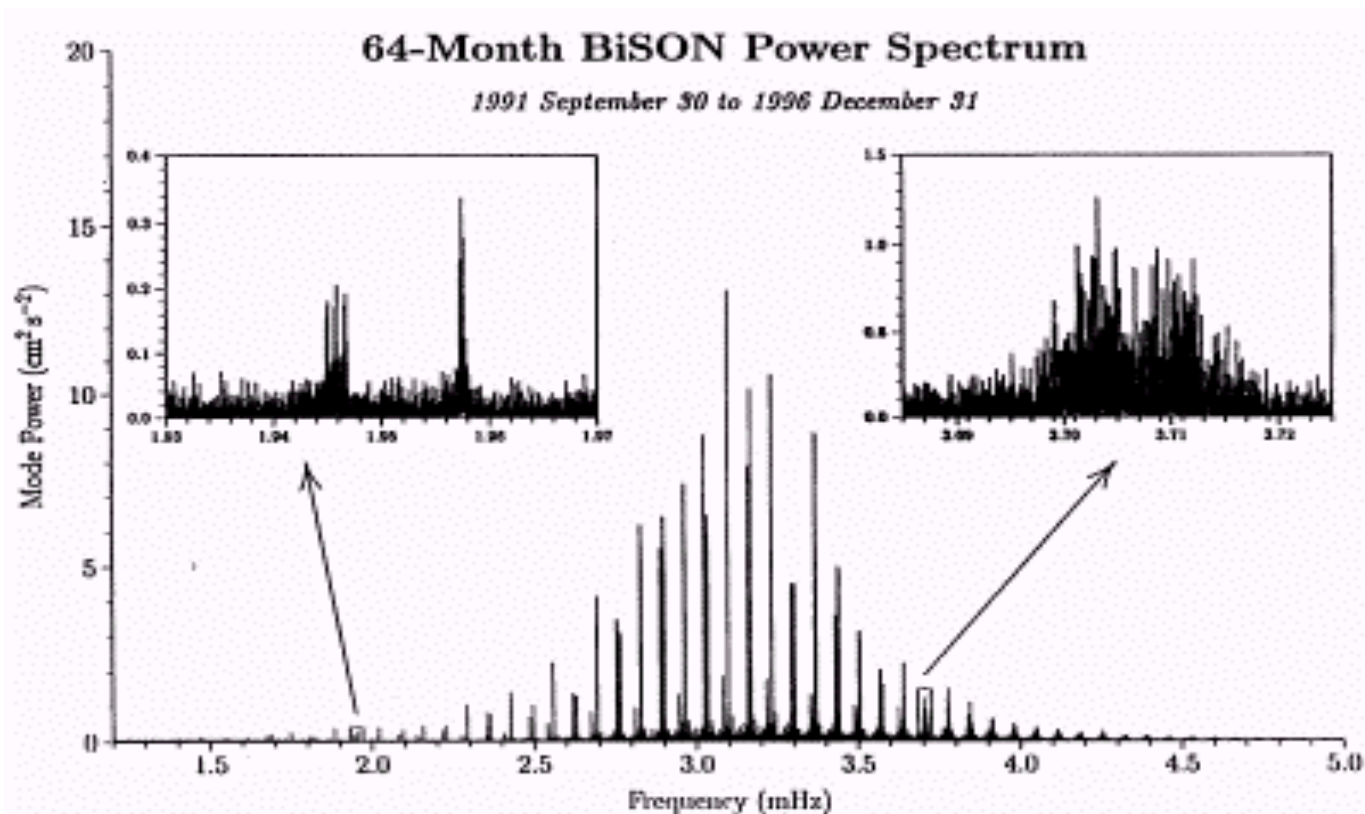
Extracting rotation 2

Fitting methods return biased estimates when the splitting is much less than the linewidth – the rotation rate is overestimated.

M-C simulations can be used to estimate the bias in difficult regimes...

...and Bayesian statistics may help extract more robust splittings

Conclusions

- May need protocol for returning estimates of large spacing (see AsteroFLAG poster, Chaplin)

- May need to supplement "local" fitting for some stars – can investigate by simulation

- Activity cycle effects present a challenge but may be characterised in some cases

- Extraction of rotational splitting may well need supplementing by input from simulations, and new statistical approach

RESULTS GALLERY
The BiSON 5-year spectrum

64-Month BiSON Power Spectrum
1991 September 30 to 1996 December 31