



# Spectral Deconvolutions

- PCA (©Asensio Ramos)
- (CS (©myself) )

A. López Ariste



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~~- (CS (@myself))~~

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# Michiel's insights

Deconvolution is ill-posed → Regularization

Spectral information is scattered over PSF

Spectra measured by spectrographs are  
coherent information structures

Therefore

I can deconvolve regularizing with the spectral  
information available

I can deconvolve regularizing with  
the spectral information available

HOW?

Michiel's answer:

The inferred model from an inversion  
condenses the spectral information into a  
**few dimensions**

I can deconvolve regularizing with  
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Michiel's answer:

The inferred model from an inversion  
condensates the spectral information into a  
**few dimensions**

→ **Sparsity**

I can deconvolve regularizing with  
the spectral information available

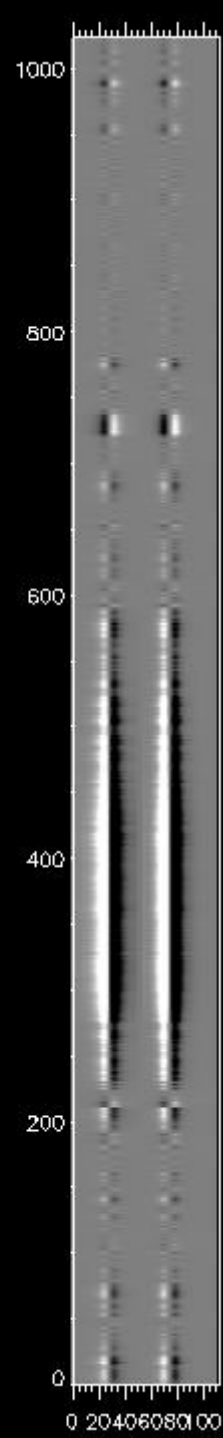
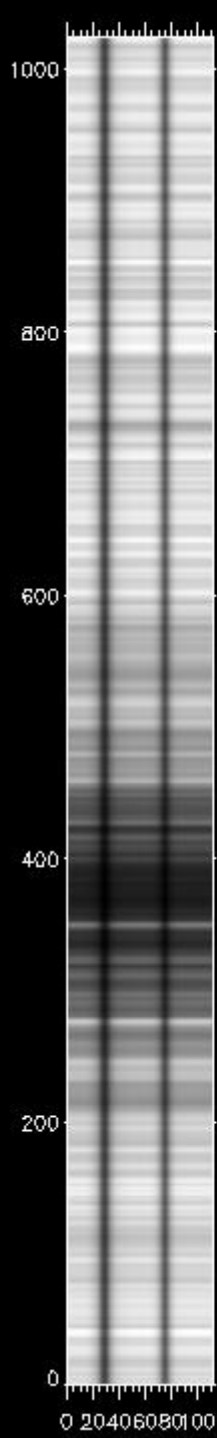
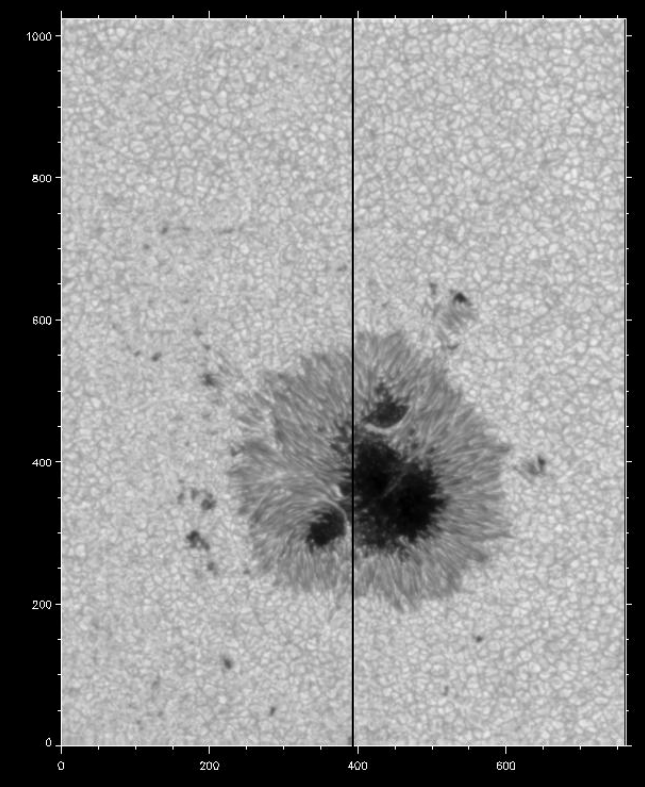
HOW?

Andrés insight:

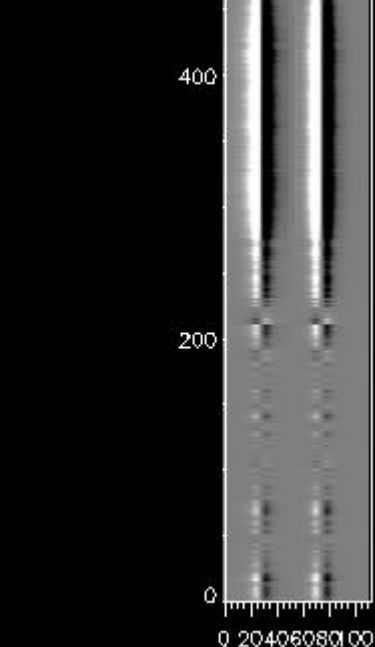
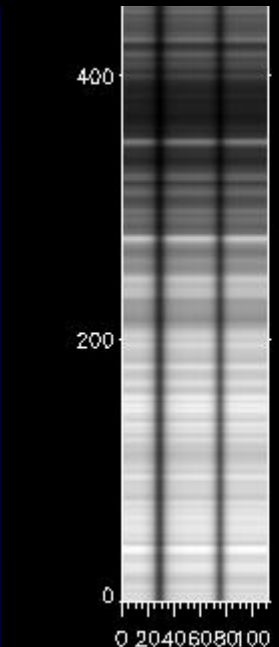
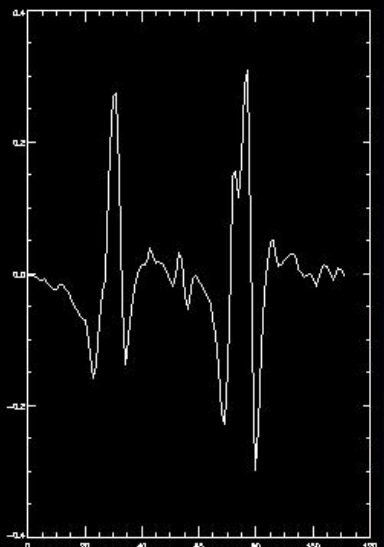
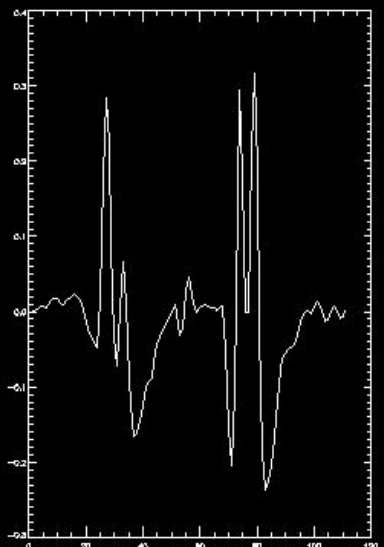
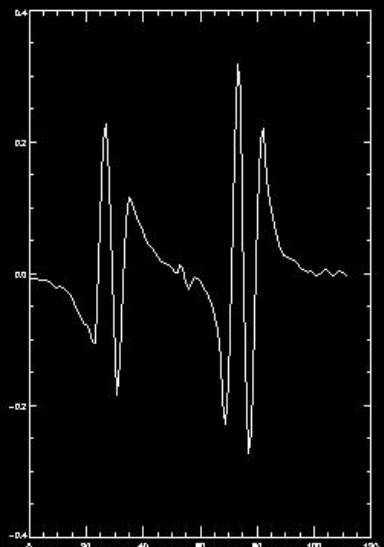
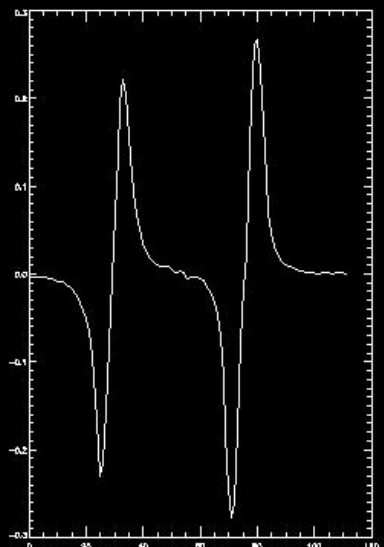
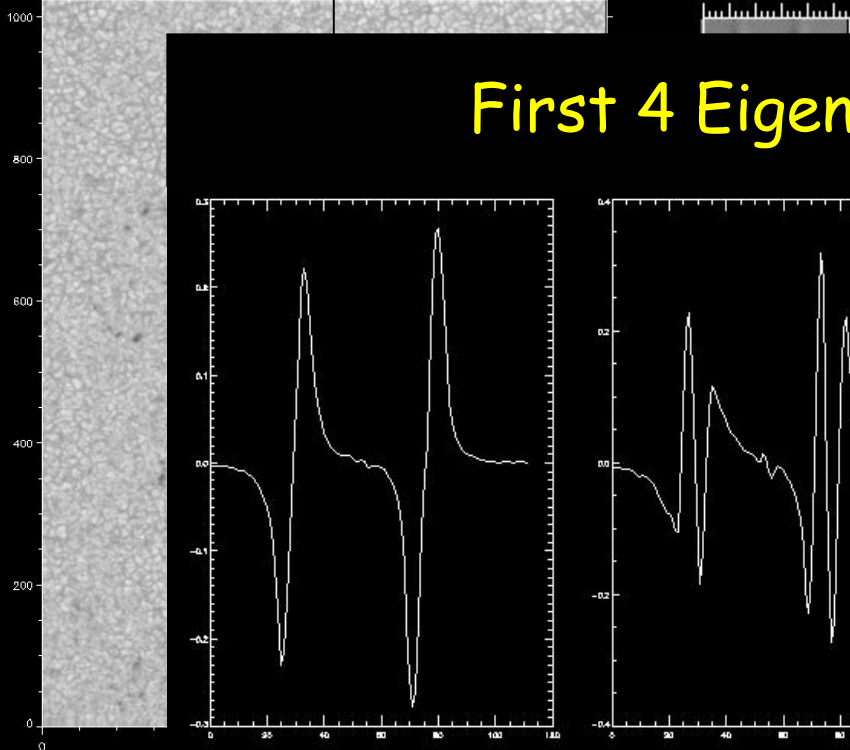
Michiel says the spectral information is sparse  
and can be used to regularize the deconvolution.  
In which space is spectral information sparse?

Andrés answer:

Spectra are SPARSE when PCA-decomposed  
PCA'd spectra can be used to regularize the  
deconvolution



# First 4 Eigenvectors of Stokes V

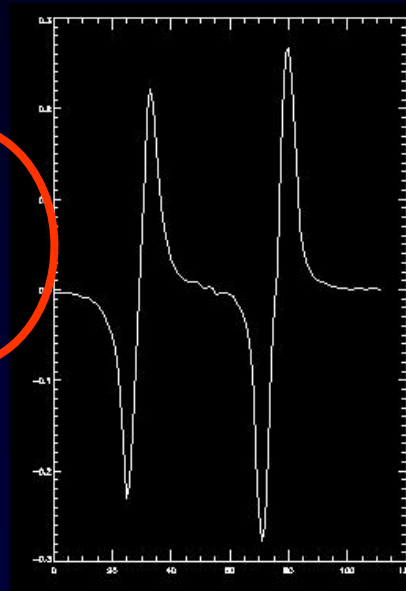




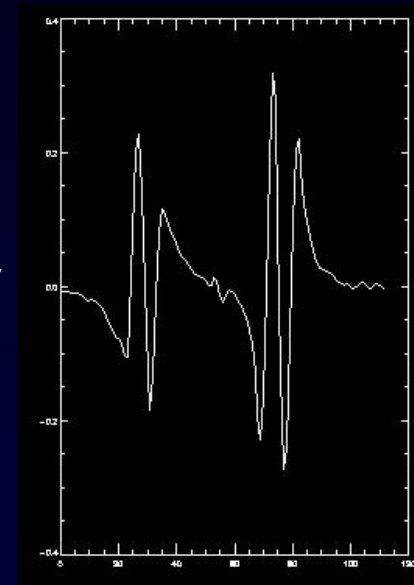
# Observed Profile



= C1



+ C2



+ ...

We can build an image of C1's

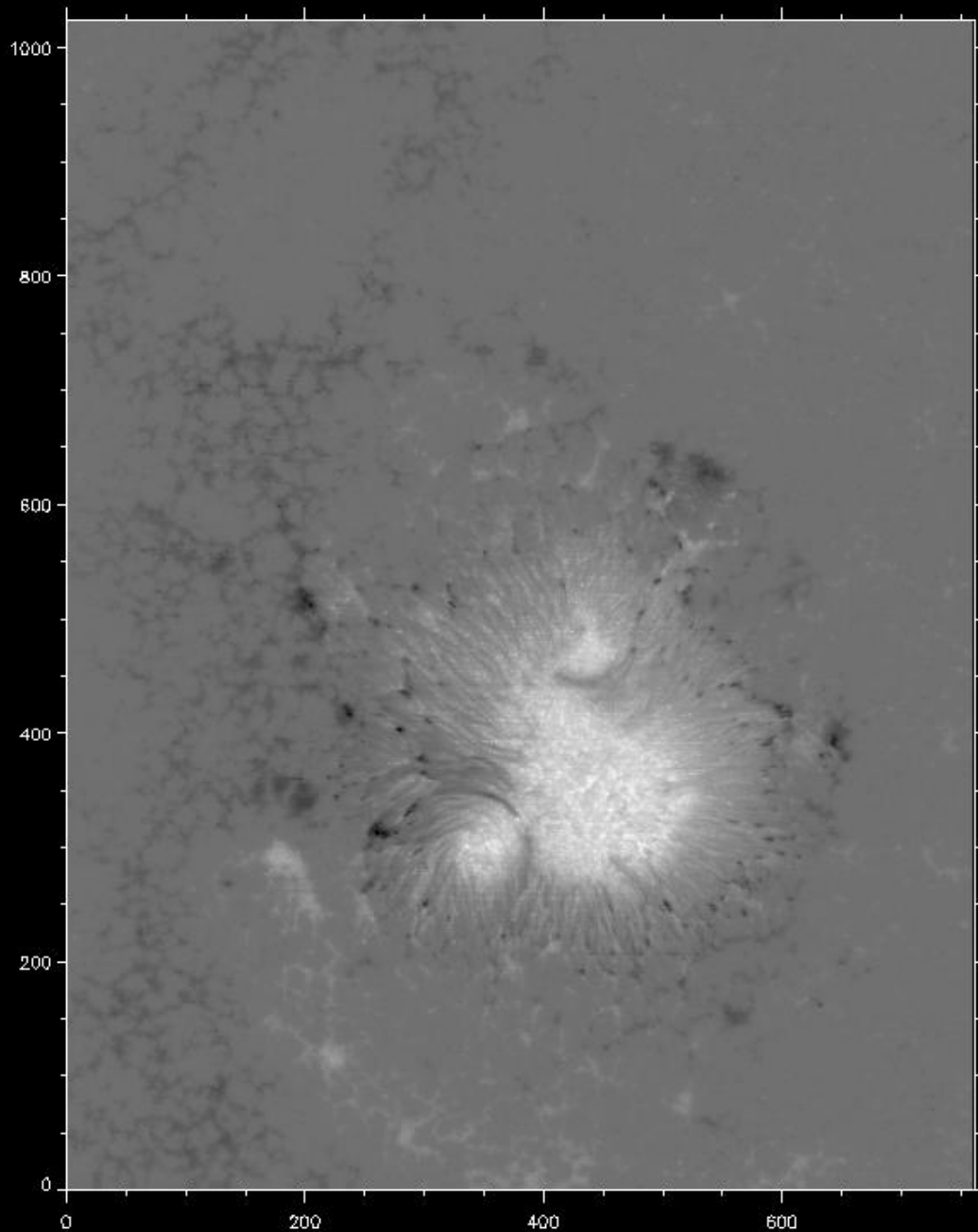


Image of the  $C1$   
coefficients

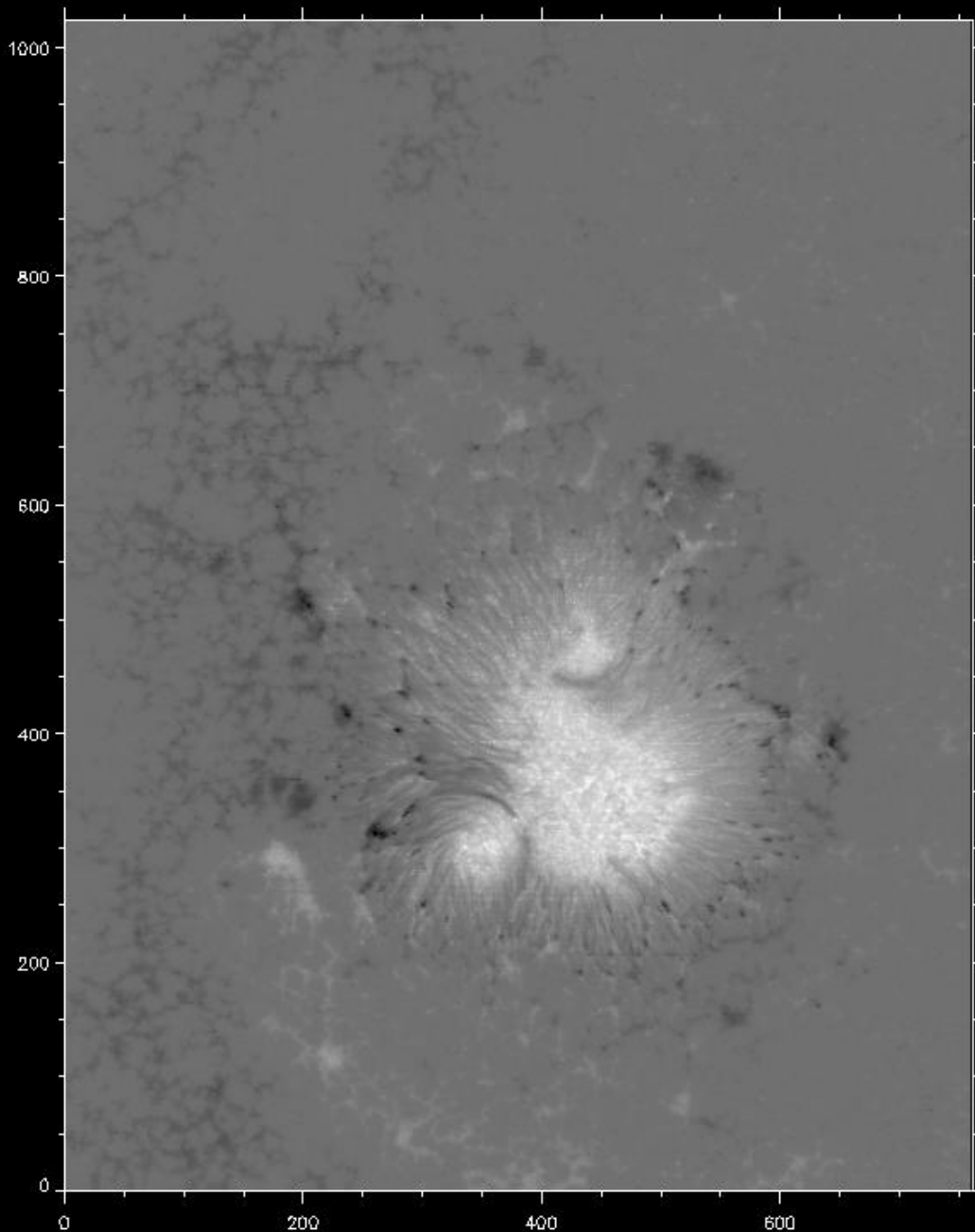
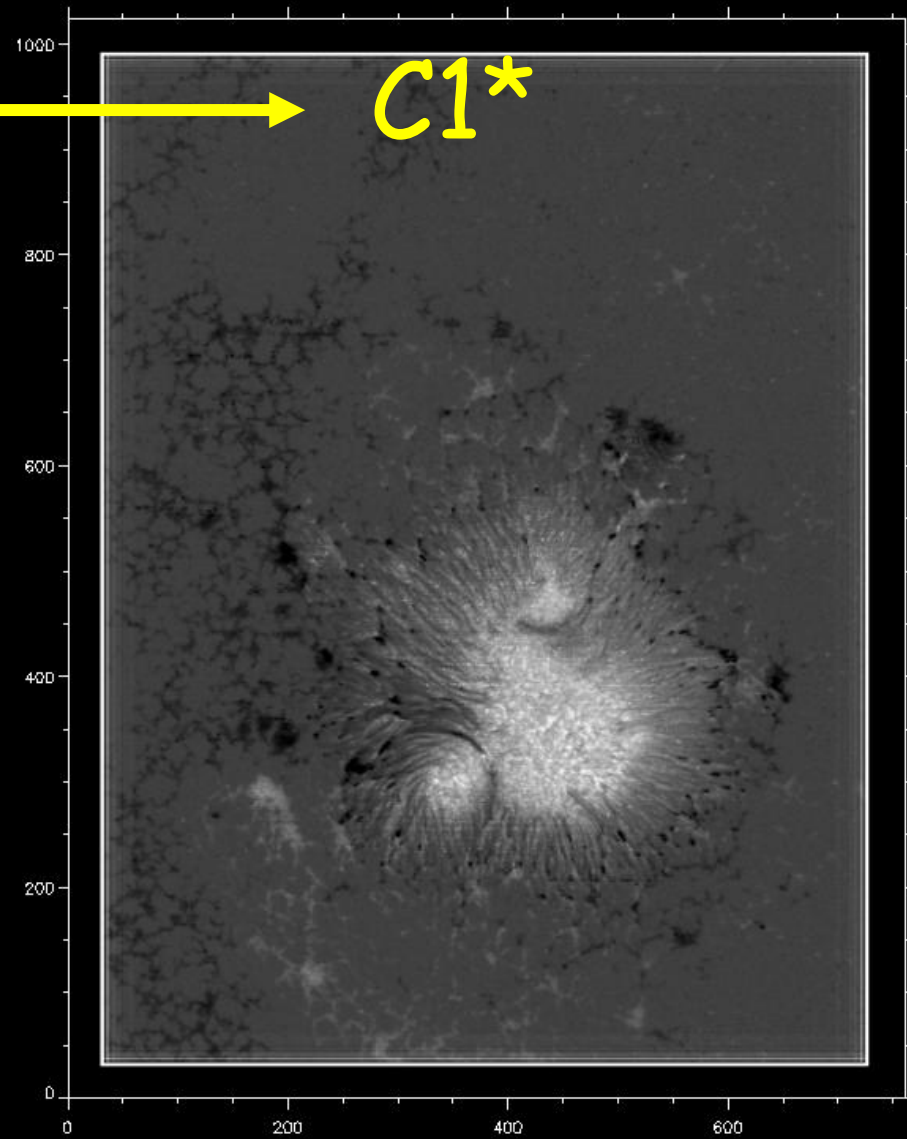
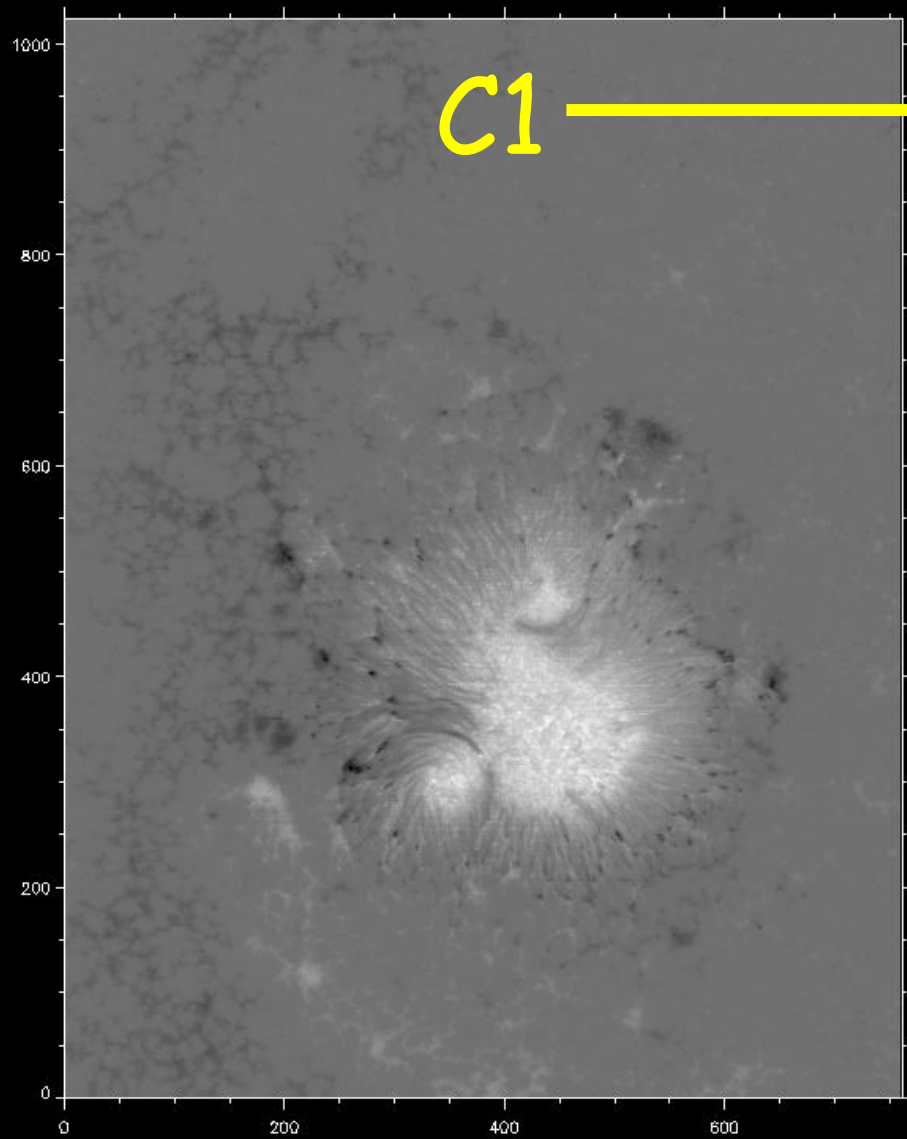
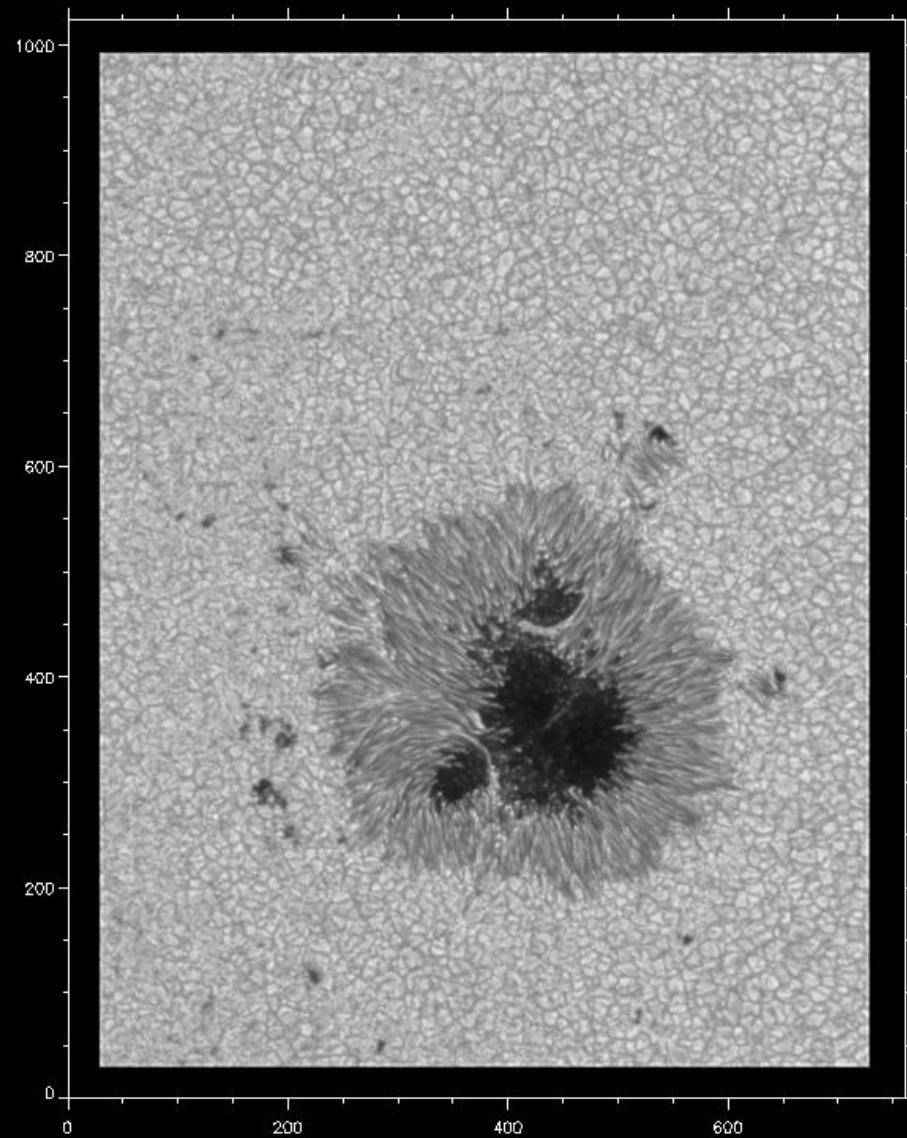
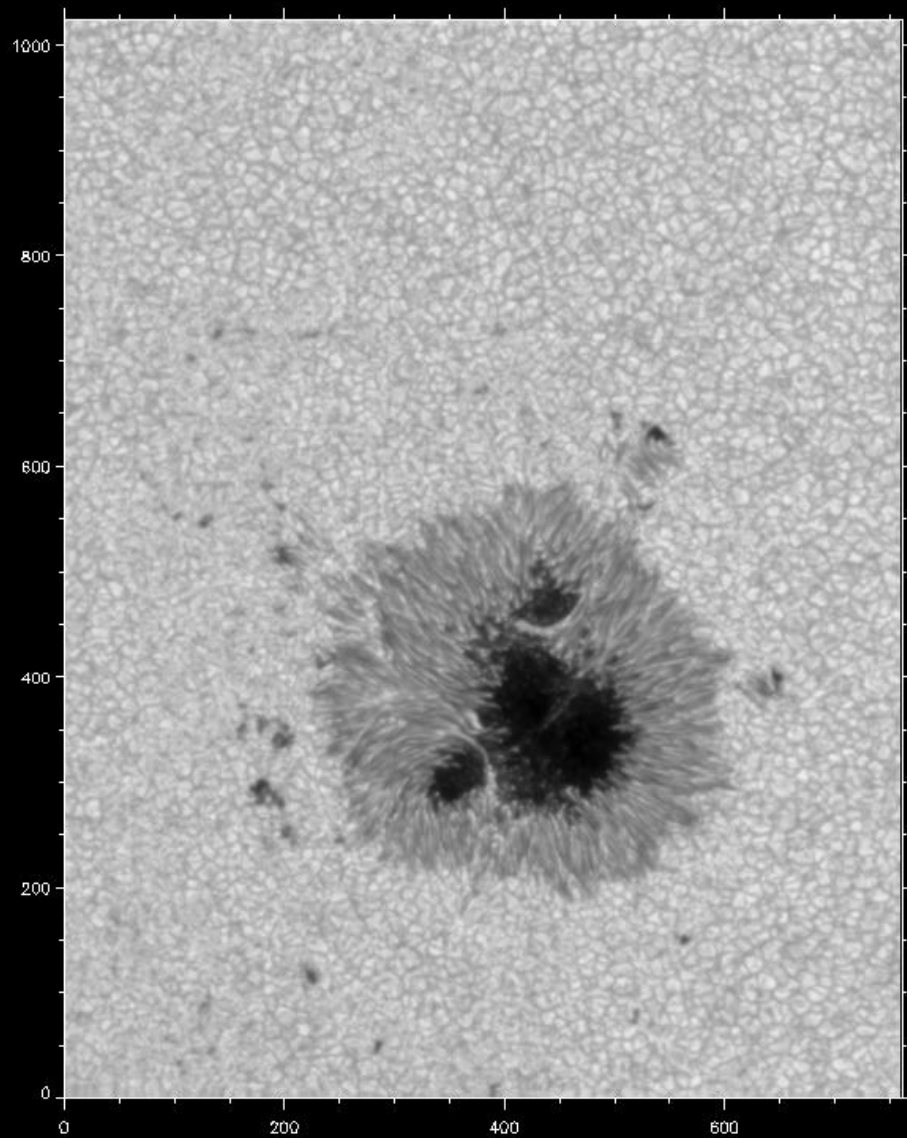
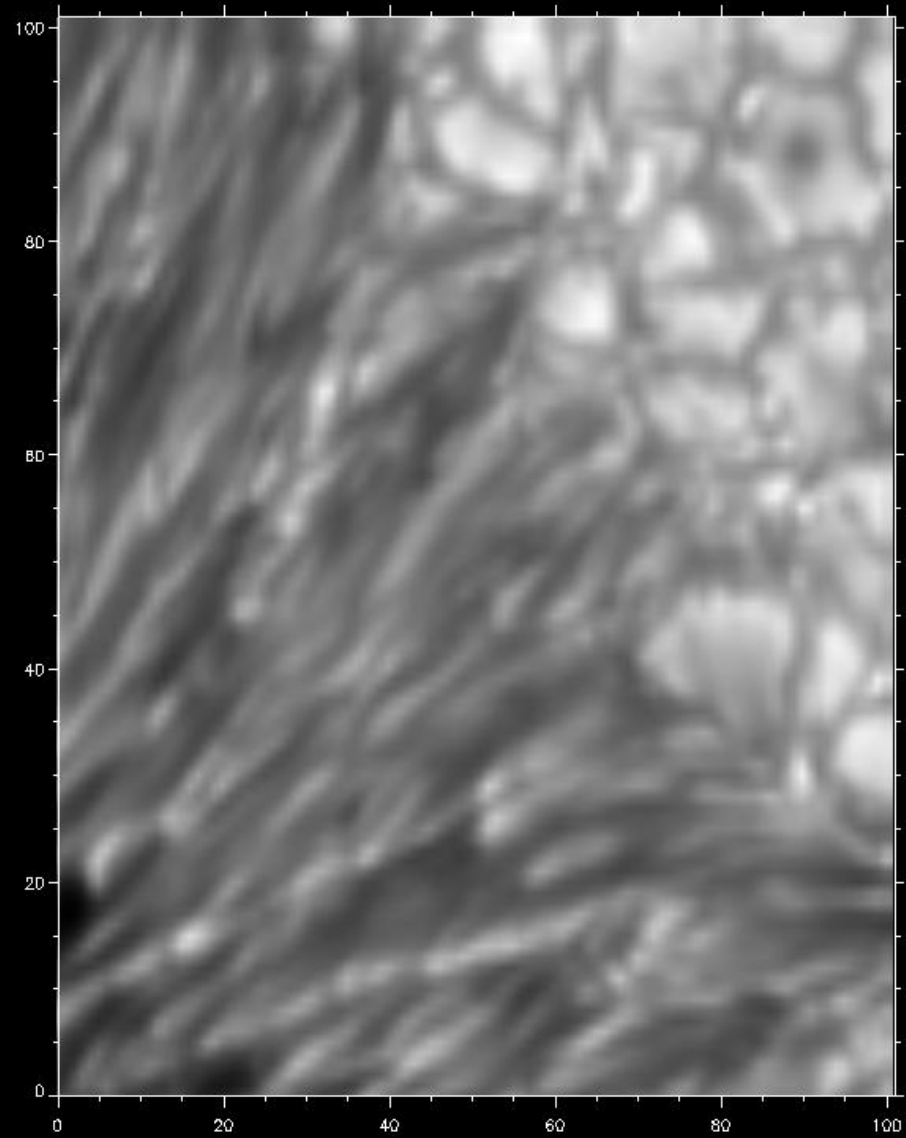
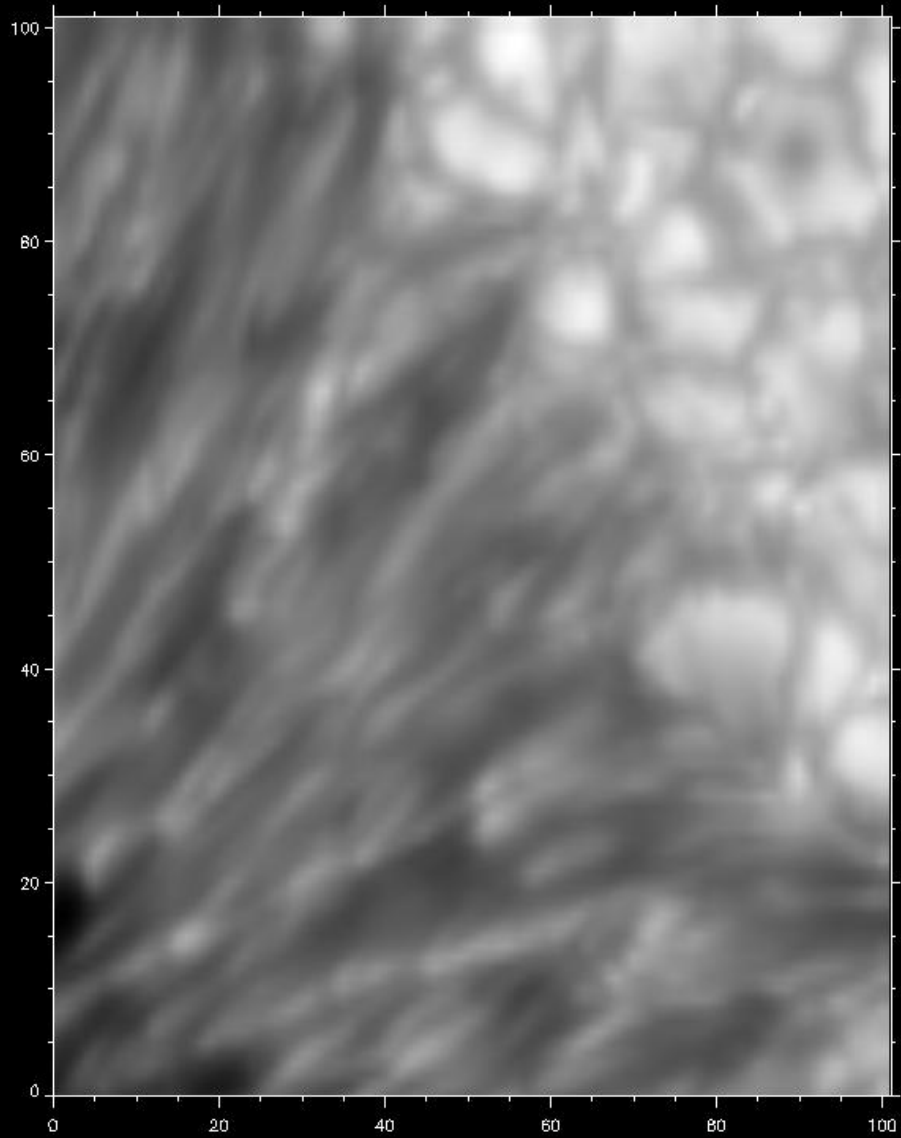


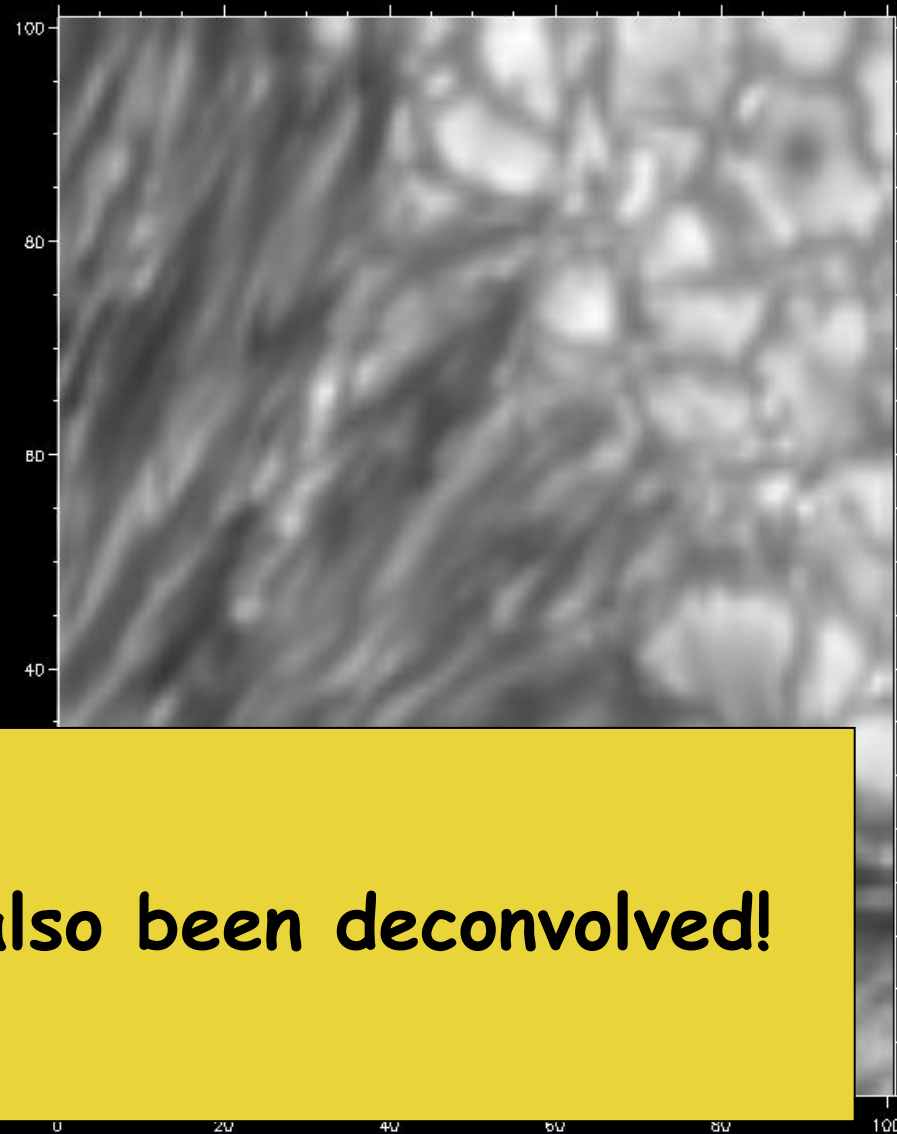
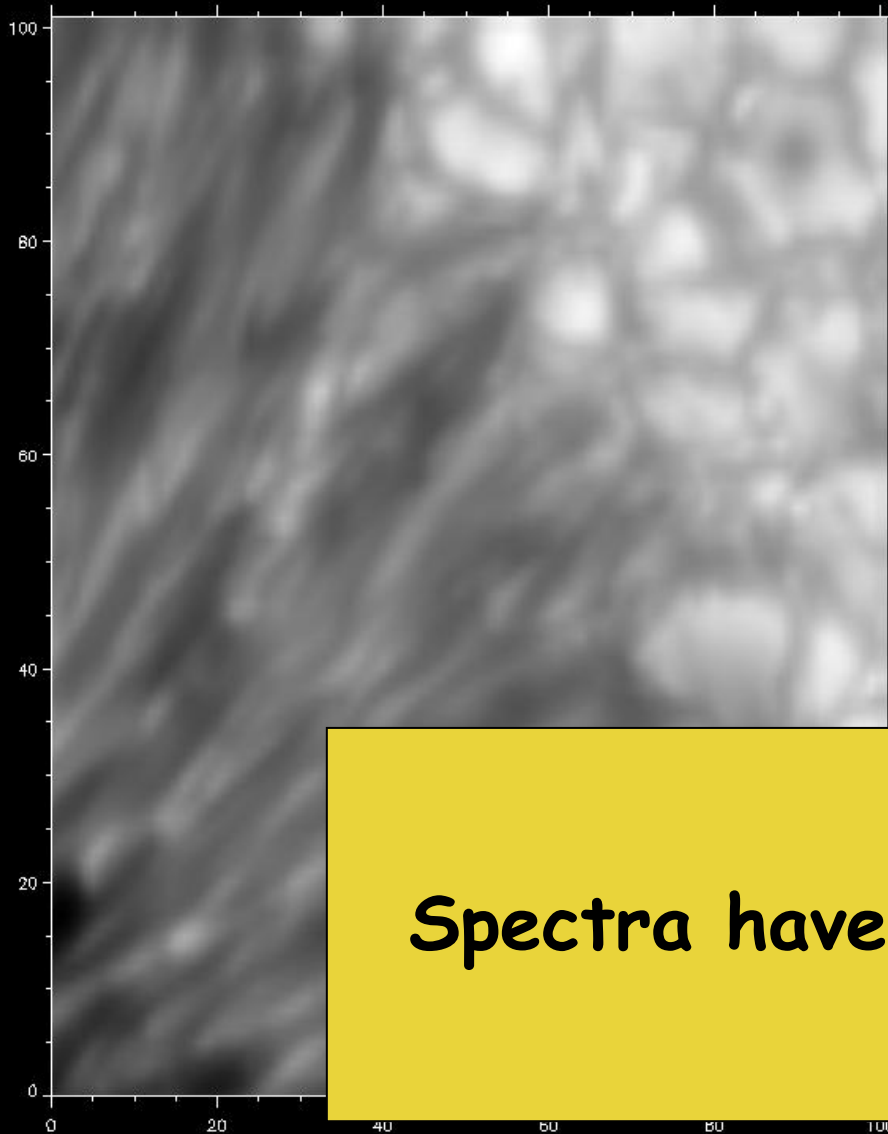
Image of the C1  
coefficients

Richardson - Lucy  
Deconvolution  
Using known Hinode PSF

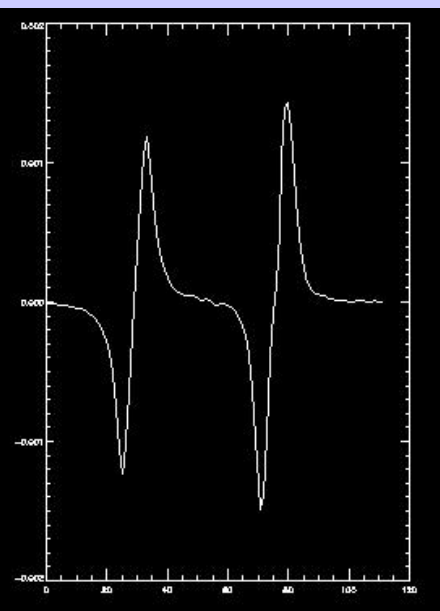
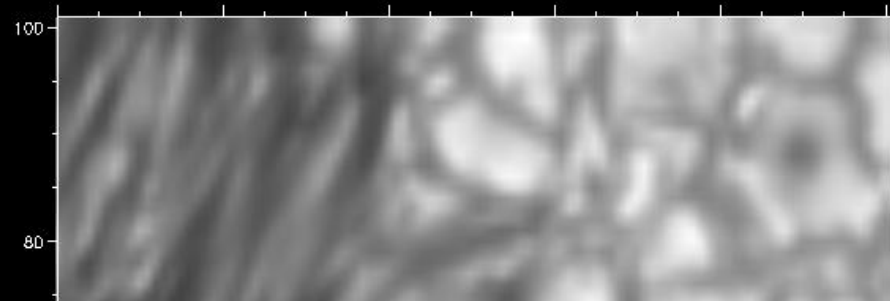
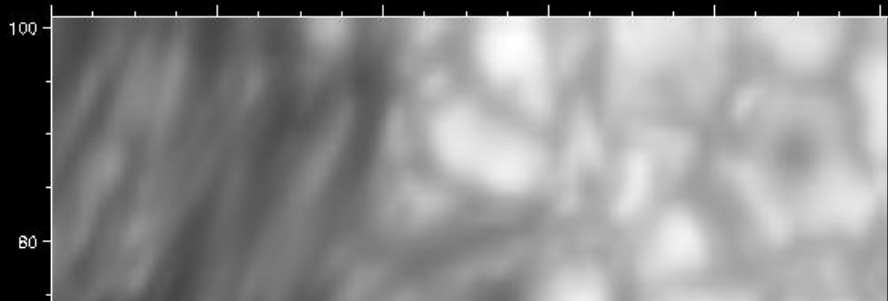




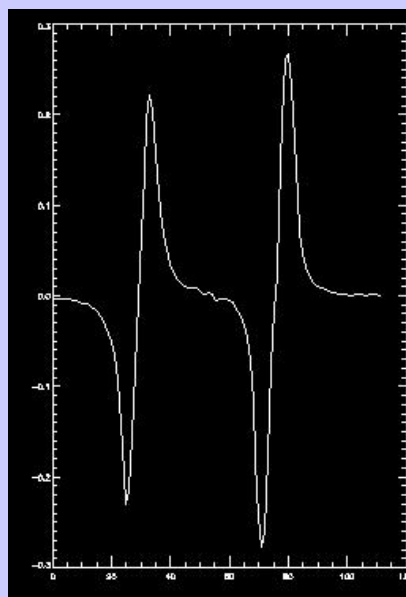




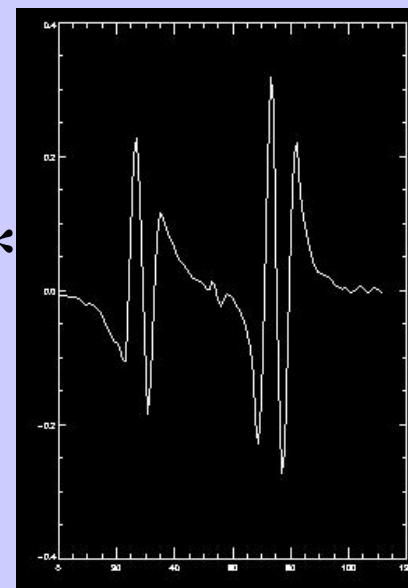
**Spectra have also been deconvolved!**



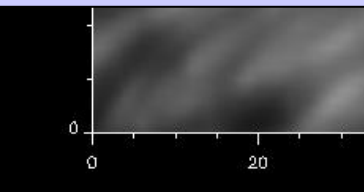
 C1\*



 C2\*







Spectra have also been deconvolved!





Code available in  
[github.com/aasensio](https://github.com/aasensio)

# Sparsity rules