

Far-Side Seismic Imaging with HMI Observations

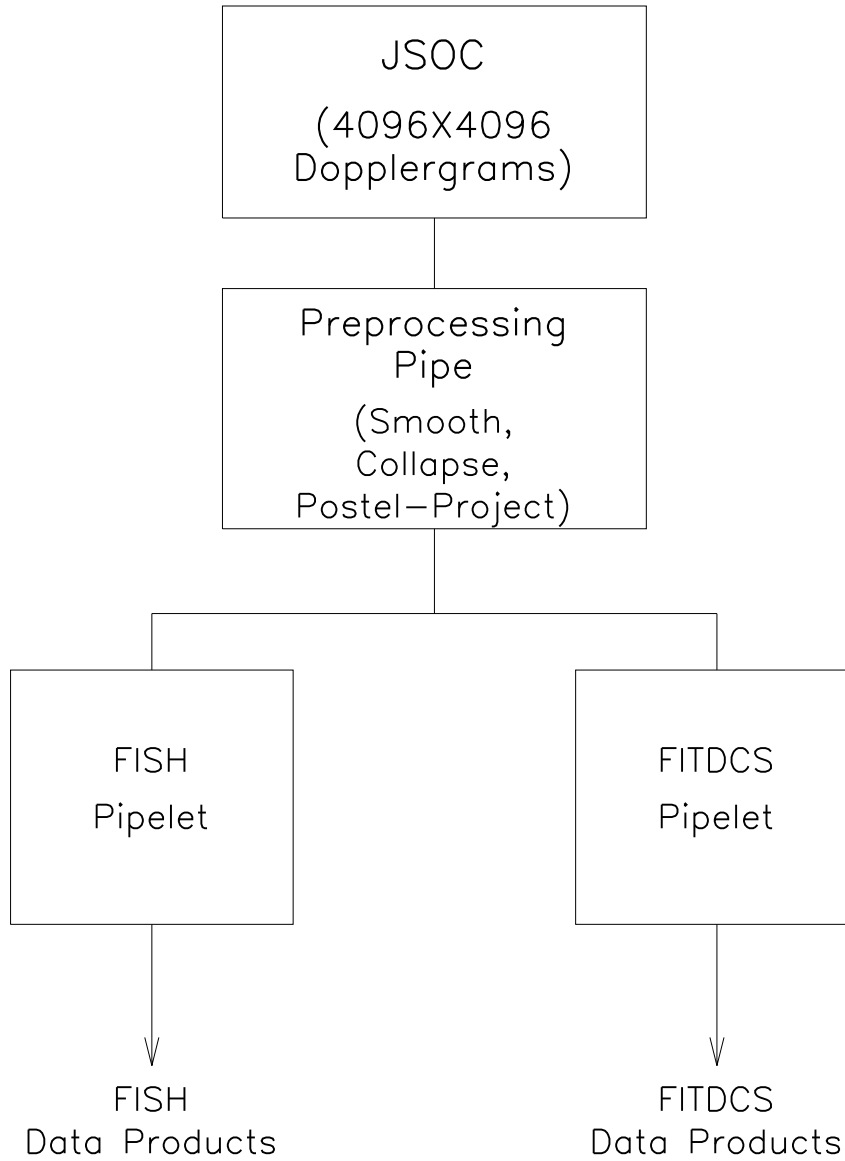
Charlie Lindsey

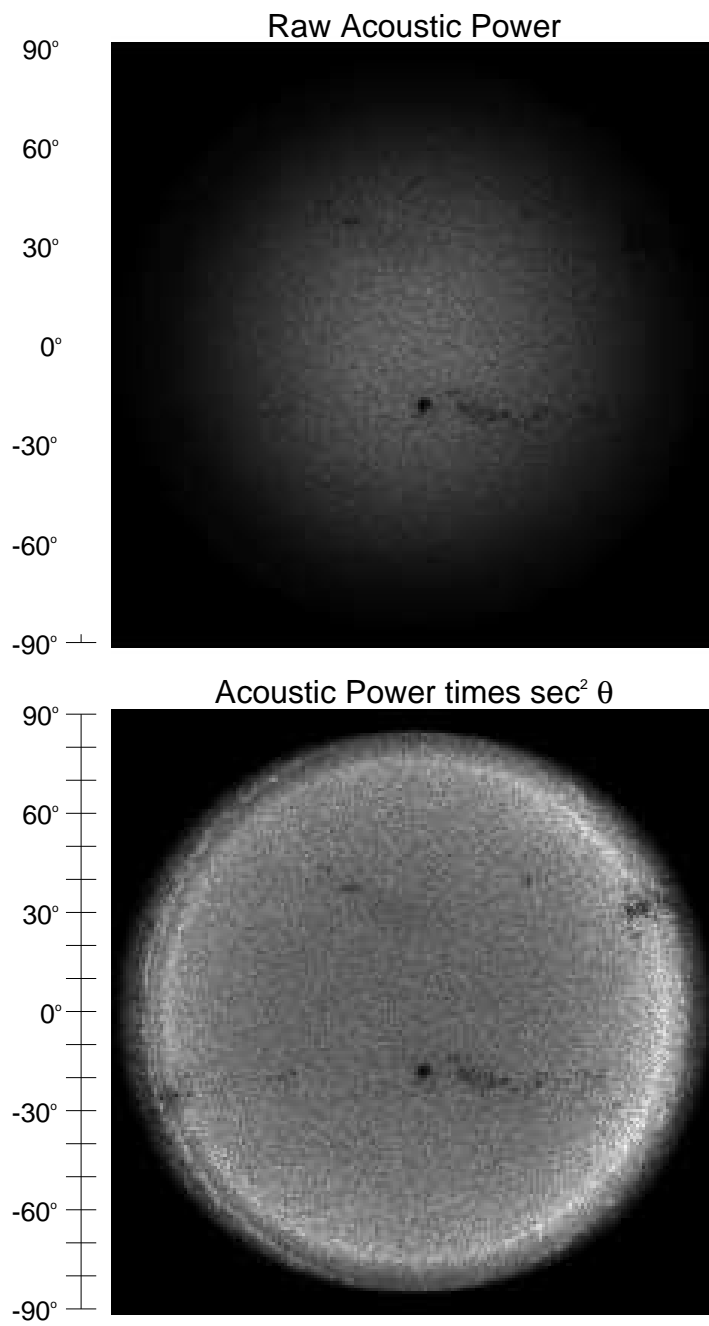
Irene González Hernández

and

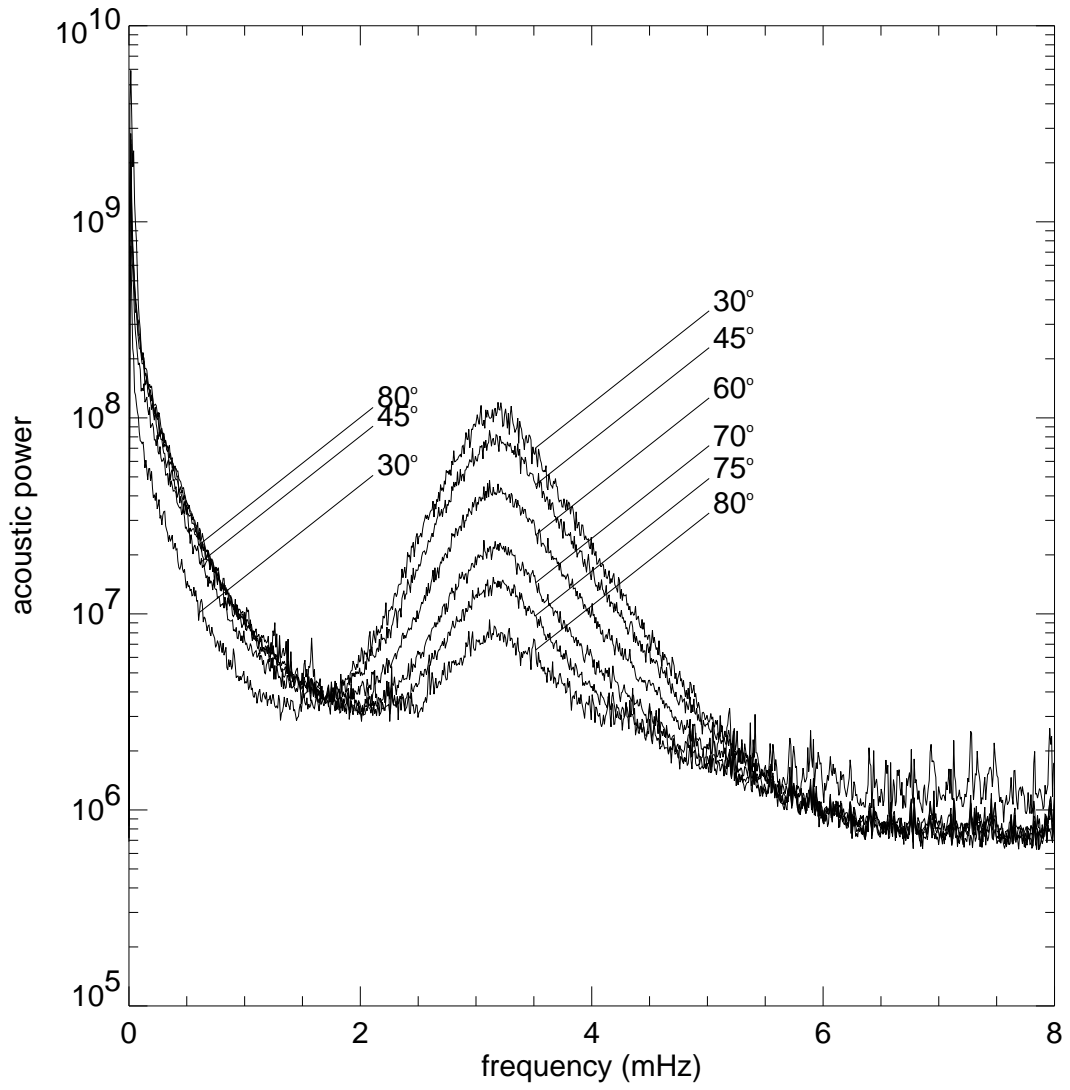
Junwei Zhao

The FISM Pipeline

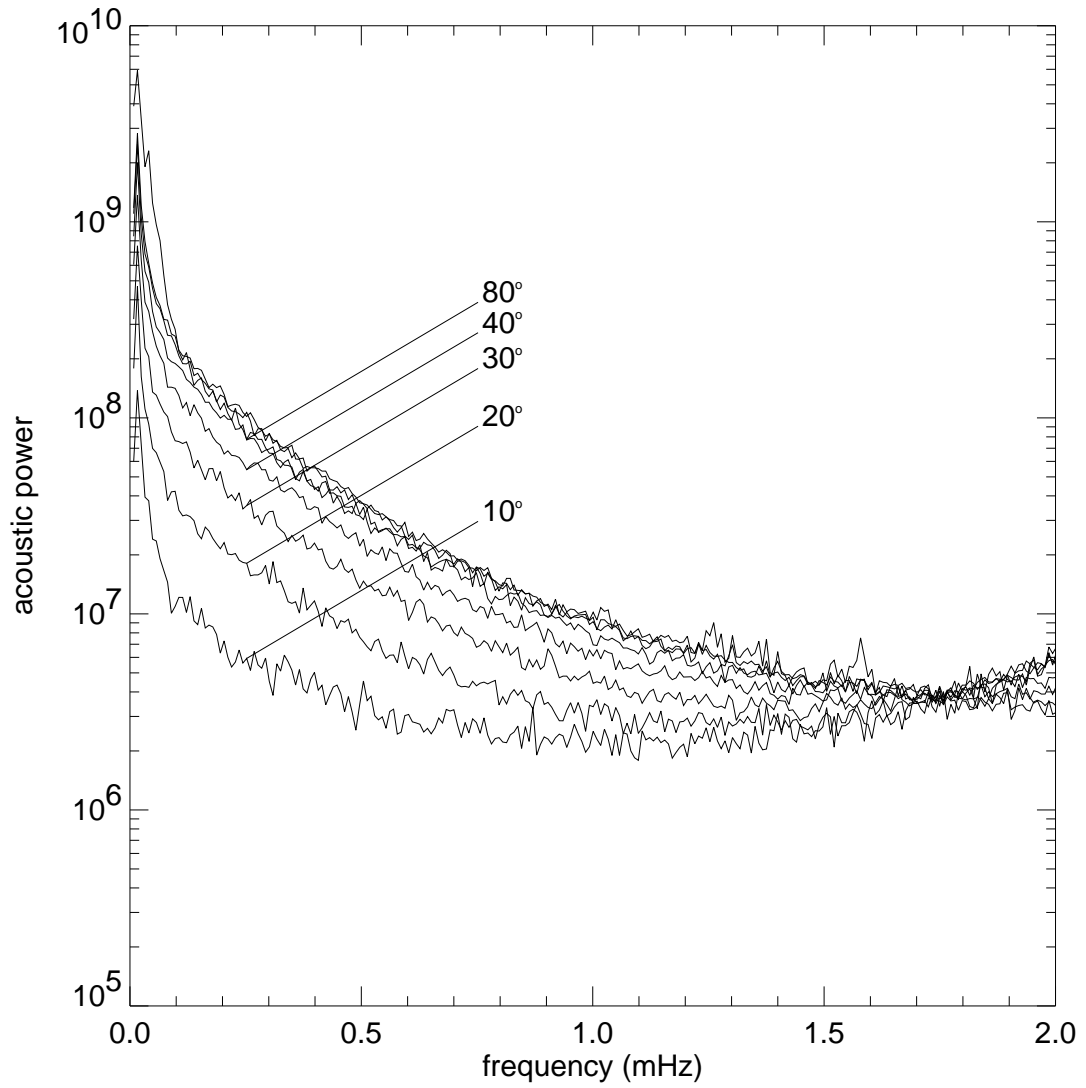




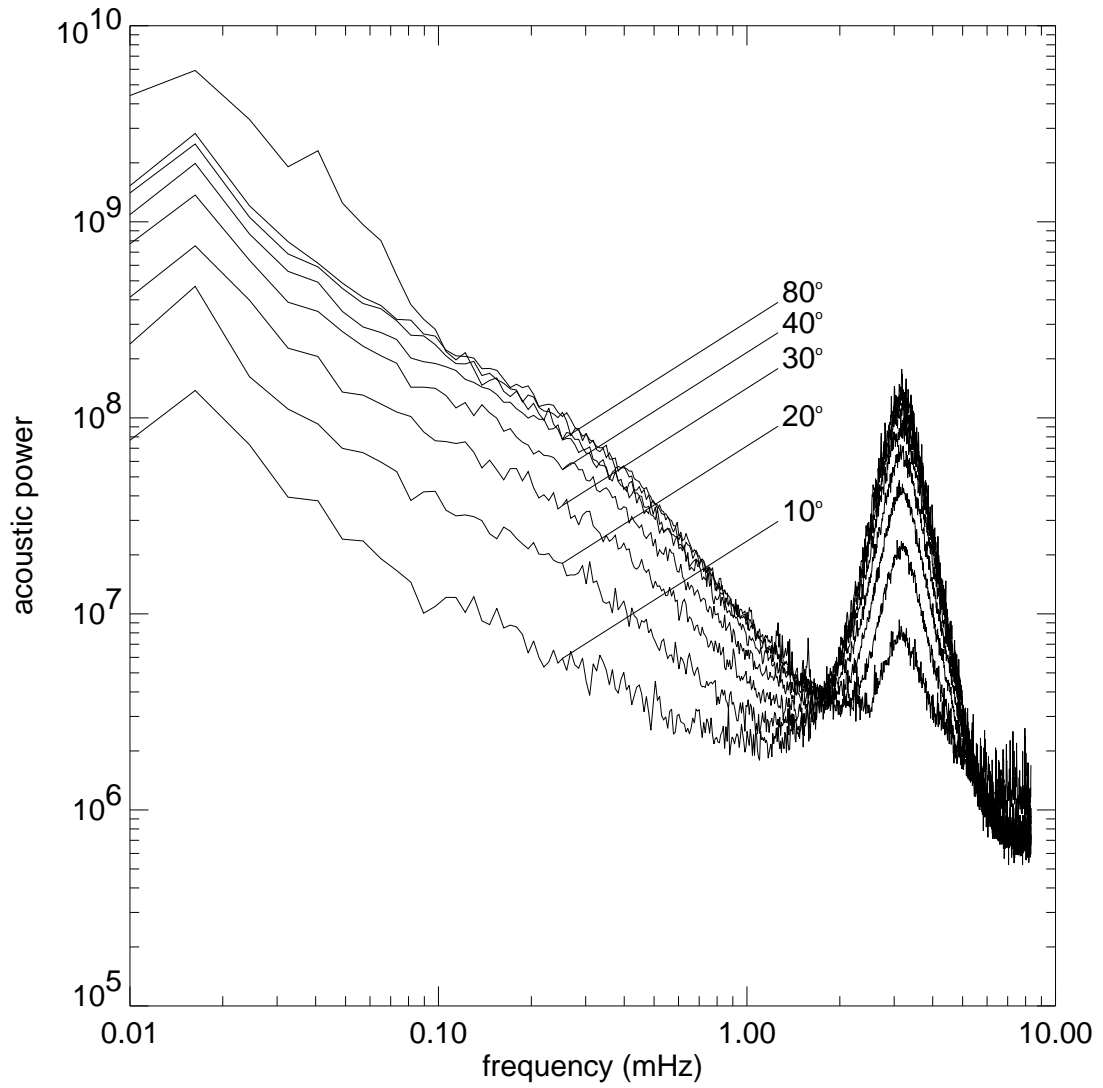
Dependence of Acoustic Power
on Vantage



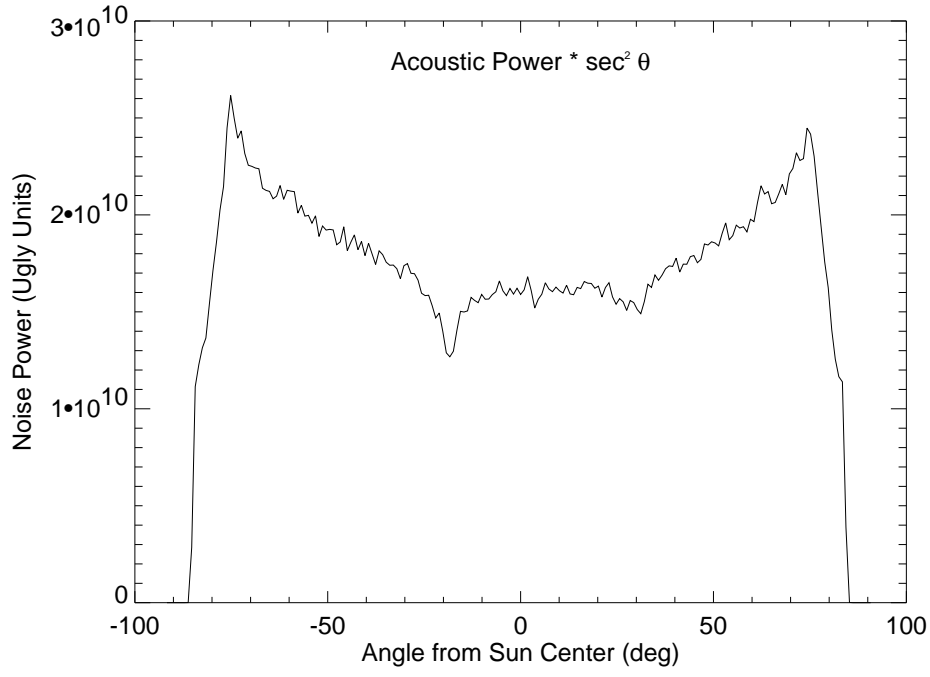
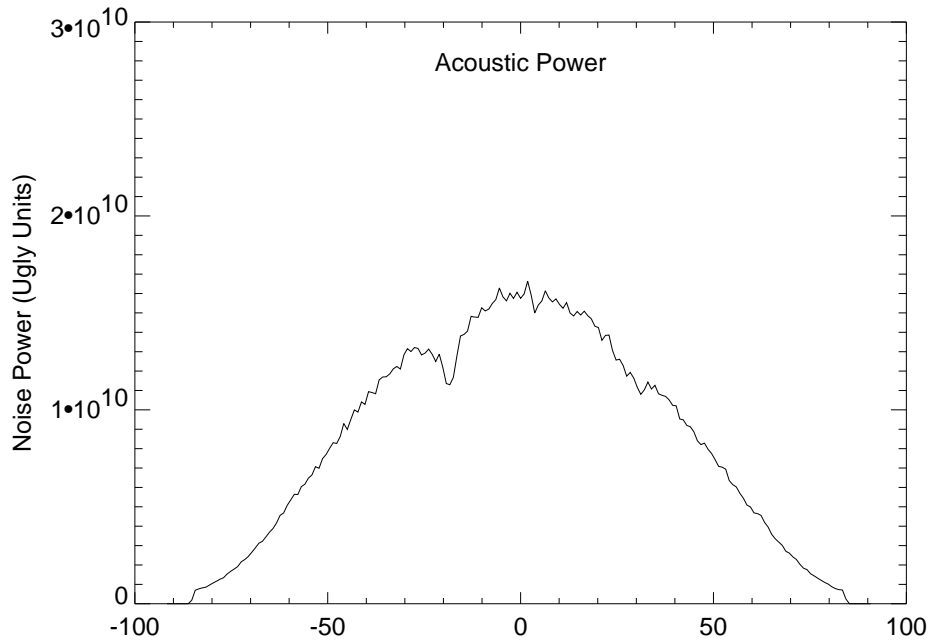
The p-Mode Spectrum



Spectrum of Convection



Convection and Acoustic Motion
on a Log-Log Scale



Plots of the Vantage Dependence

Quality Considerations

GONG far-side images have a significantly greater signal to noise than MDI images. We need to understand why.

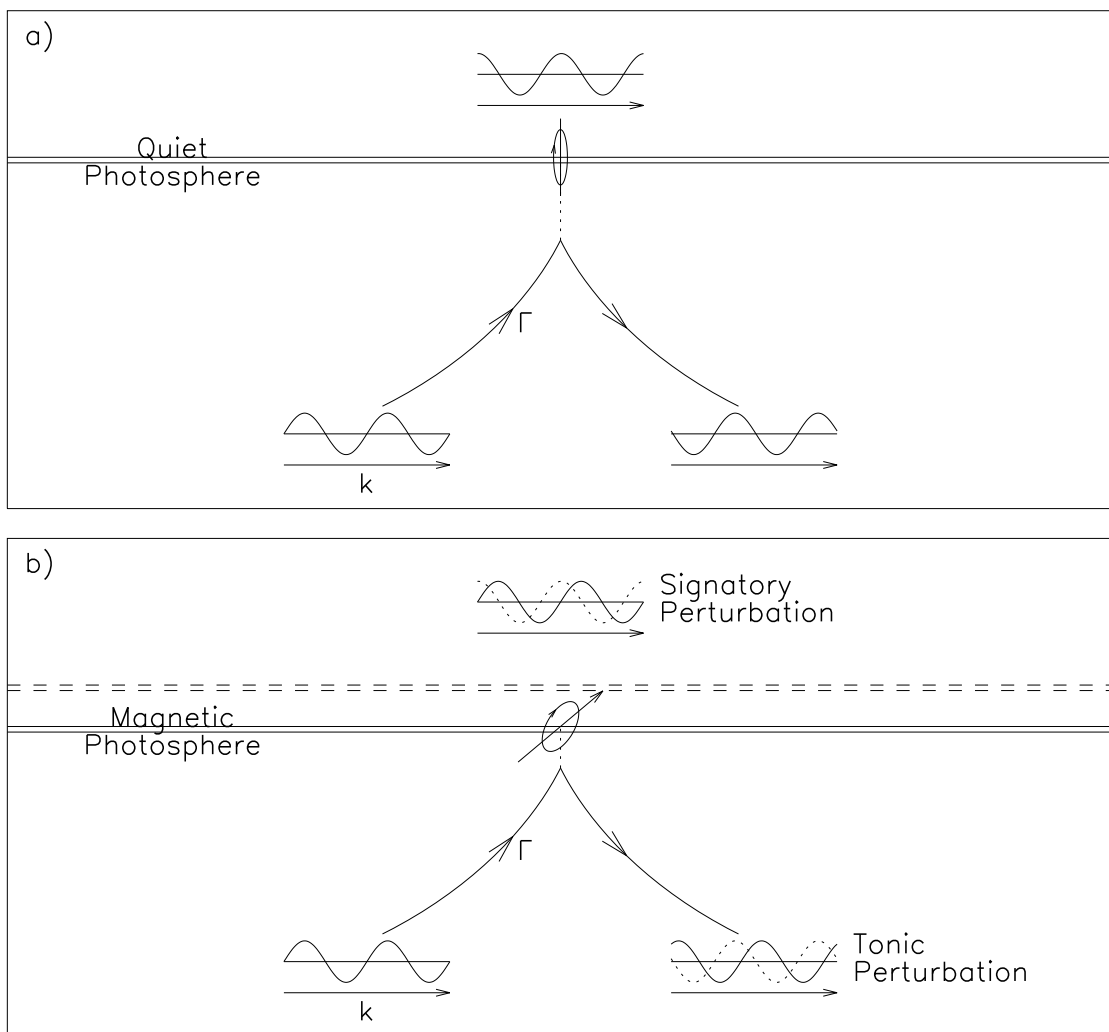
Possible Reason: Significant signal can be lost by collapsing the MDI images before Postel projecting them.

This could not be avoided for the MDI synoptic far-side program. The GONG FSI pipeline does avoid it. The HMI pipeline can and will avoid it in any case. It will also allow us to see the benefits of Postel-projecting the image before collapsing it.

Finer Spatial Discrimination: Even the MDI has far greater nominal discrimination than far-side imaging requires or can accommodate. However, approaching the solar limb, foreshortening destroys some of this spatial discrimination. The benefit of increased spatial discrimination is the ability to extend the effective “pupil” of far-side helioseismic reconstructions limbward.

A Reduced Collapse Factor: Phil Scherrer suggests that greater quality can be accomplished by a reduction in the degree to which the helioseismic images are collapsed before the major phase-correlation computations are undertaken, and that there are better methods of collapsing the observations than simple binning of pixels. The computational labor goes as approximately the fourth power of the collapse factor. Hence, a factor of two finer discrimination is 16 times the labor. However, we have the computational facilities to do the labor now.

Benefits of an Account for Horizontal Acoustic Motion: Jesper Schou points out significant possible benefits in an account for horizontal acoustic motion of p-mode disturbances near the limb.



Parallel Processing: Plans are under development to adapt the far-side holography code for parallel processing. This will greatly facilitate experimentation needed to understand how far-side seismic diagnostics actually work, hence how to improve them.

Summary

Very nice work the Stanford and Lockheed are doing to meet the heavy scientific demands of the HMI project with the advent of first light, including what we need for far-side imaging. Prospects for improved far-side seismic imaging of HMI observations at this point are highly preliminary, but very promising.