

Amplitude ratios and phase shifts in solar-type stars

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Project of  
**PLATO WP126000 : Mode Physics**

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Why is there need for a WP “**Mode Physics**”?

The **understanding** of the physical mechanisms which govern mode driving and damping is *still rudimentary*, but mandatory to

- provide a better understanding of stellar **surface effects**, such as **turbulent Reynolds stress**, **nonadiabaticity**, granulation, magnetic effects, and in which way they affect the pulsation properties.
- provide realistic descriptions of stellar **oscillation properties**, such as **mode lifetimes**, **amplitudes** and **phases**:
  - (i) to improve the modelling of artificial data (End-To-End simulator)
  - (ii) to help target selection.

→ **Need for theoretical efforts**

Courtesy of K. Belkacem

The structure of WP “**Mode Physics**”

**WP126100: Mode amplitudes and surface effects on mode parameters (R. Samadi)**  
Development of efficient tools for a realistic determination of mode amplitudes across the HR-diagram.  
Modelling of sub-surface effects on mode parameters.

**WP126200: Mode linewidths (M.A. Dupret)**  
A quantitative estimate of mode linewidths across the HR diagram.

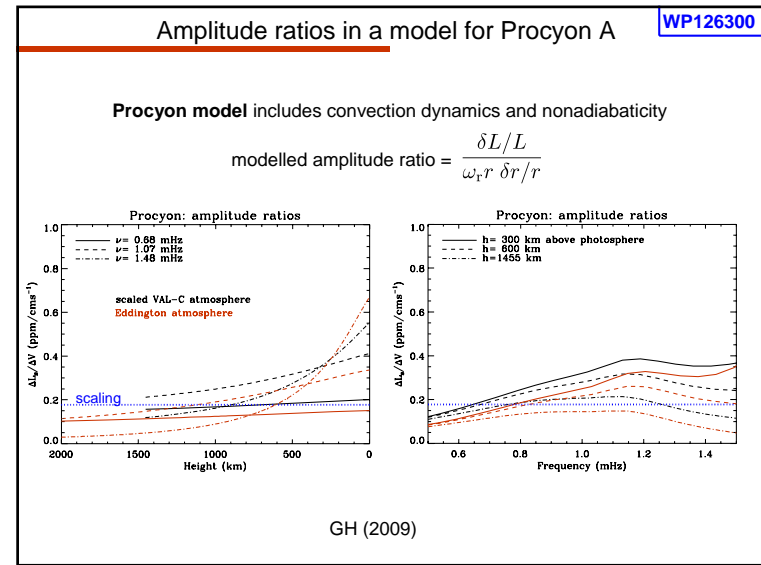
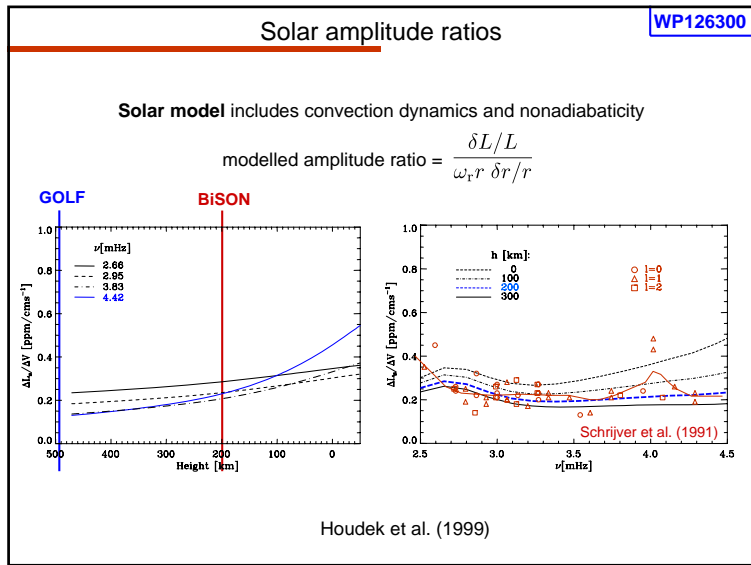
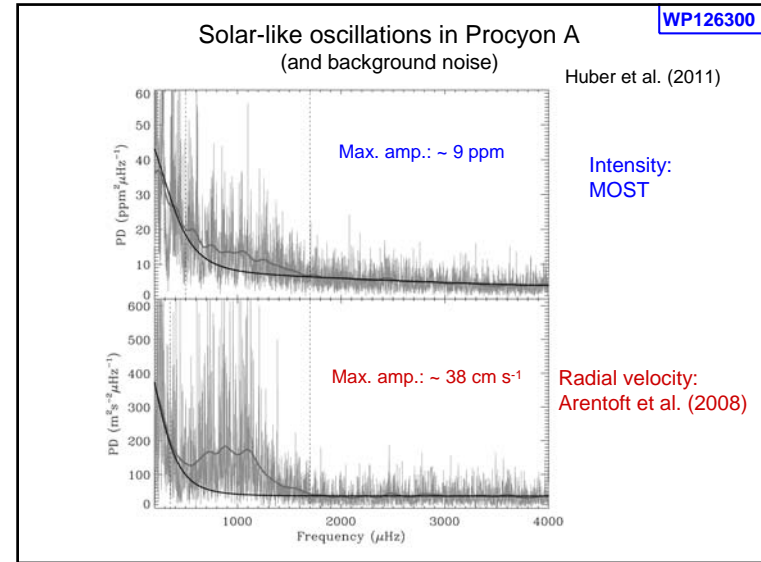
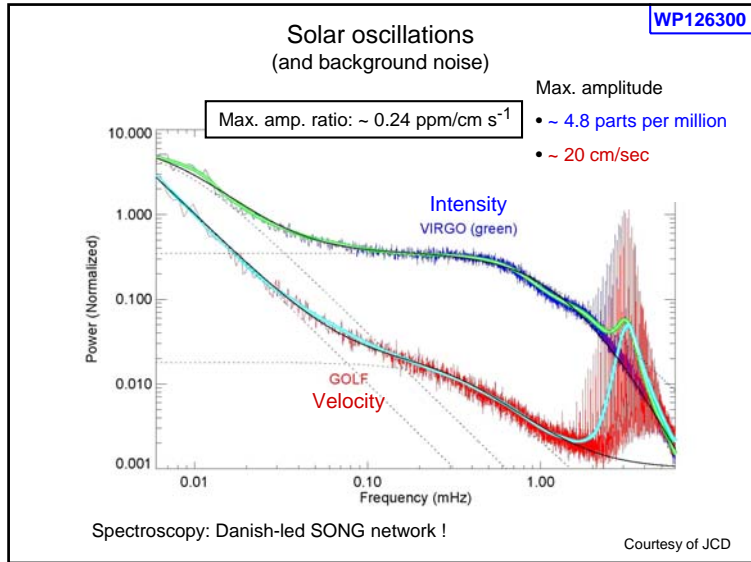
**WP126300: Intensity-velocity pulsation relations (G. Houdek)**  
Relations between intensity-velocity oscillation properties provide, for example, excitation-model-independent information on mode eigenfunctions.

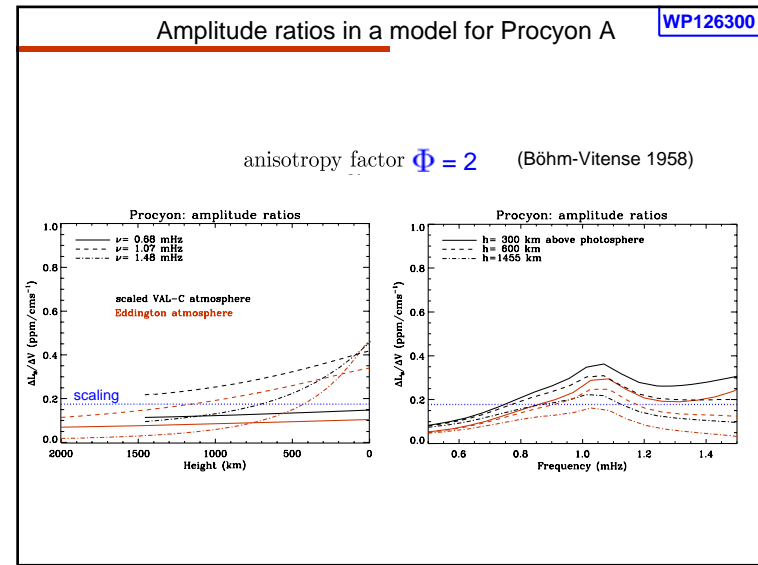
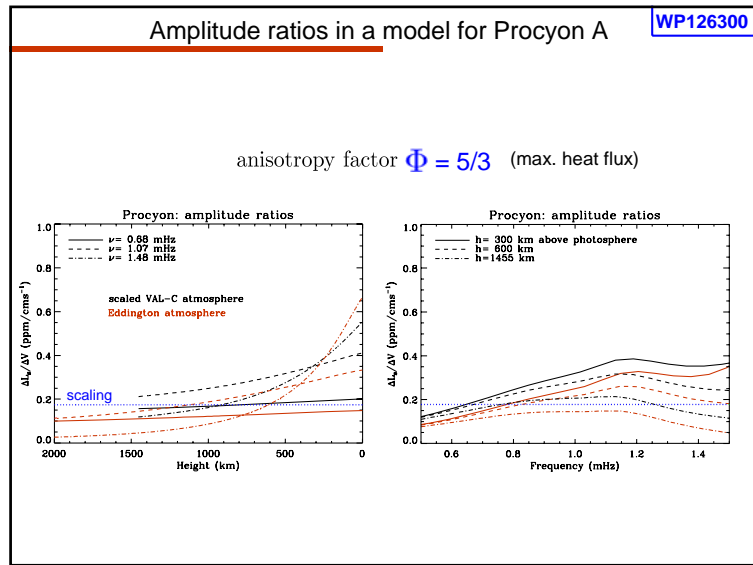
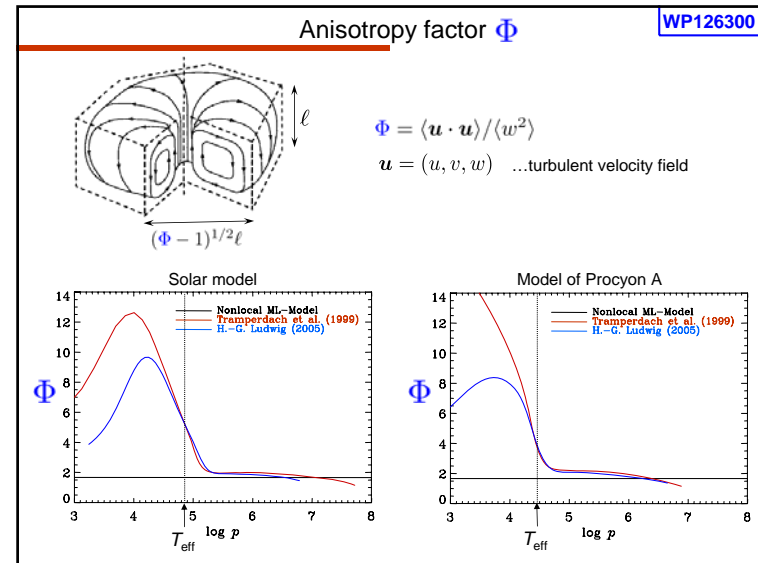
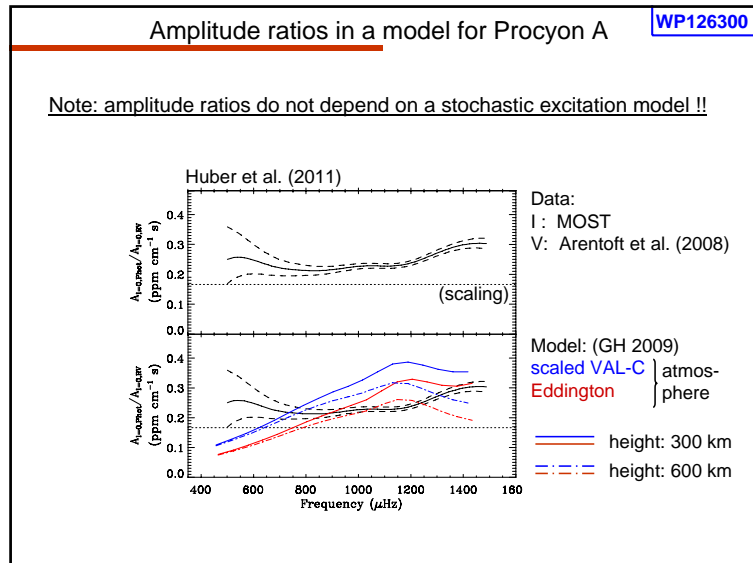
**WP126400: Seismology of magnetic activity (L. Gizon)**  
The main objective is to characterize and parameterize the influence of magnetic fields on mode parameters.

Courtesy of K. Belkacem

WP126300

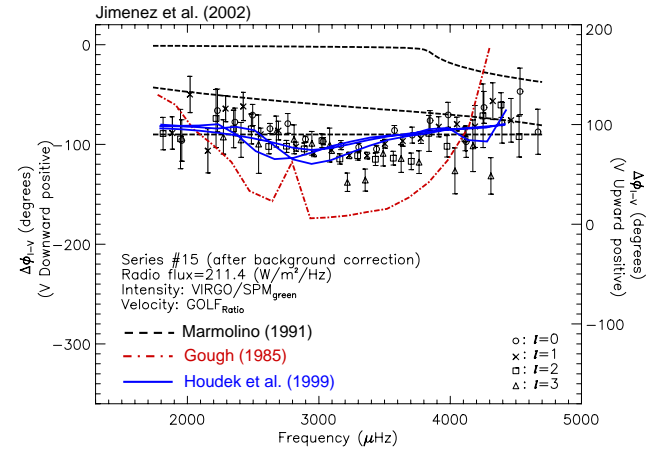
Amplitude ratios



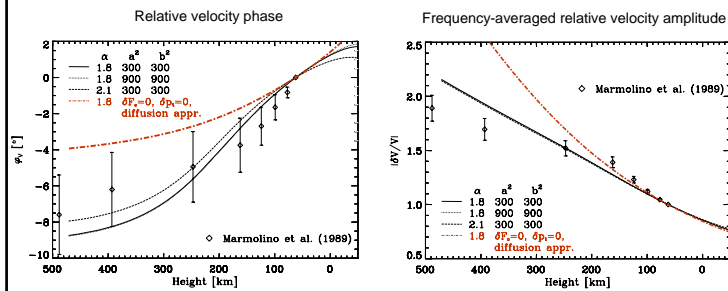


## Phases in the solar atmosphere

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## Summary / Conclusion

- Amplitude ratios and pulsation phases provide valuable information on the shape of the pulsation eigenfunctions and consequently also on the stellar stratification, without the need of a model for stochastic mode excitation.

- This (observational) information constrains the physical processes in the still ill-understood surface layers.

- Convection dynamics and nonadiabaticity crucially modify the oscillation properties in the surface layers: the use of (improved) time-dependent convection models is essential to reproduce the observations.

- PLATO will observe stars bright enough for contemporaneous ground-based observations in spectroscopy (SONG !!!).